# KEY

TUTOR's GUIDE; 2.W.a.

ORTHE

## ARITHMETICIAN'S REPOSITORY.

CONTAINING

The SOLUTIONS of the QUESTIONS, &c. in the Tutor's Guide.

With the References as they stand in the Eighth Edition.

To which is added (where necessary)

Some USEFUL RULES, &c.

Likewife

## AN APPENDIX.

Shewing the Combination of Quantities; the different Ways they may be varied; with the Method of filling the Magic Squares, &c.

The Whole being principally defigned for the Ease of Schoolmasters, and, with the Guide, furnishes a more Complete and Extensive System of Arithmetic, than any extant; and will enable all those who are acquainted with the first Principles to attain a competent Knowledge of the several Rules, with Ease and Precision.

The SIXTH EDITION, carefully revised and corrected.

## By CHARLES VYSE.

K.

L O N D O N,

PRINTED FOR G. G. AND J. ROBINSON, No. 25,

PATERNOSTER ROW.

MDCCXCV.

MVSEVM BRITANNICVM THE

# PREFACE.

WHAT gave Rise to the following Sheets, was my receiving Letters from several eminent Mathematicians, and Schoolmasters, wherein they expressed great Desire for such a Performance, mentioning the Utility such a Work would be to Schoolmasters in general; as the Tutor's Guide contained such a Variety of Questions, suitable to all Capacities, and adapted for the Use of the Gentleman and Scholar, as well as for the Man of Busi-

ness.—But as many of the Questions are long and difficult, made it impossible for Schools in general to make Use of the Guide, without the KEY, the Time in Schools not admitting; therefore they gave me great Hopes of Encouragement, by promising to make Use of the TUTOR'S GUIDE in their own Schools: beside recommending it to all Schoolmasters in Great Britain, as the most complete Epitome of Arithmetic, or Question Book, extant; and, with the Key, would enable the Tutor to instruct ten Pupils with greater Ease, more correctly, and with less Perplexity both to himself and Scholars, than one by any other Book. Thus encouraged, and at the same Time being sensible of the favourable Reception the GUIDE has met with, gives me great Hopes that the following Pages will meet with that Encouragement, due to so useful and laborious a Work.

The Title Page gives a short Account of what the following Pages contain, which I think needless to enlarge upon, therefore shall leave the Book to speak for itself; and if it does not give satisfaction to the Reader, I am sure all I can say in its Behalf will never recommend it: but this may be justly said, whoever reads it over, will find the Solutions of a greater Variety of Questions than in any other Treatise on the same Subject; and are performed in as intelligible, and comprehensive a Manner, as my Bounds would admit of, or even as is necessary.

How well I have performed this Work, must be left to proper Judges; and as I am not sensible of any fundamental Error in the following Pages, yet I cannot pretend to say it is without Imperfections; which I hope the good-natured Reader will excuse, and pass over with the like Candour and Good-will with which it was composed for his Use, by

CHARLES VYSE.

THIS Edition serves also for a little Book entitled the Scholar's Companion (Price 2s.) being an Abridgement of the Tutor's Guide, containing every Rule necessary for the first Form, or Youth designed for Trade. As I am anxious of making this Book as perfect and complete as possible, I most earnestly request, that if any of my Readers should discover any Defect in it, that they will be so obliging as to favour me with a Line, which shall be carefully attended to in the next Impression.

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#### To Mr. CHARLES VYSE.

SIR.

YOUR valuable Treatife on Arithmetic, as soon as it came from the Press, was immediately introduced into my School, where I have continued to use it ever fince; and look upon it as exceedingly well calculated to facilitate the Business of a School, in those Branches of

Learing of which it treats.

A fecond Edition falling into my Hands, it gave me great Pleafure to find by your Preface thereto, that you had fome Thoughts of giving us (in a feparate Publication) the Solutions to all the Questions at large; which would be in my Opinion of great Use to the Master, and what I wish of all things to hear you have done. I immediately wrote to my Bookseller, for the Key to your Book, but received for Answer, it was not in Print; which has induced me to give you this Trouble, to know whether that be really the Case; and whether I may expect ever to see so excellent a System of School Instructions rendered complete, by the Publication of your Key, &c.

I am, Sir,

Your most obedient humble Servant,

Sept. 16, 1773.

CHRISTOPHER CAVE,

Mafter of the Free-School, at Caister, in Lincolnshire.

### To Mr. CHARLES VYSE.

SIR,

I Purchased your second Edition of the Tutor's Guide some Time ago, with a View of being surnished with a complete System of Arithmetic, when the Key should be published; and have been very impatient for so useful a Performance, being sensible of the Utility such a Work must be to the Masters in general, particularly to those who

have the Care of a numerous School; I beg you will inform me whether the Key is (already, or intended to be) published; and you will highly oblige

Your humble Servant,

And well-wisher,

Plumpton, June 12, 1773.

ISAAC SLEE,

School-master at Plumpton, in Cornwall

#### To Mr. CHARLES VYSE.

SIR,

I Cannot help thanking you for the Pains you have fo happily employed for the facilitating of the Science of Numbers.

Solutions of Mr. Clare's very ingenious Questions have been much wanted; and it must certainly afford great satisfaction to every Lover of Figures to find that Task so well executed.

I am, Sir,

Your obliged humble Servant,

July 14, 1774.

SAMPSON WRIGHT,

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Master of the Free Grammar-School of Bradley, near Stafford.

WE have also received Letters to the same Purport, from the following Gentlemen, viz. Mr. Rigge, Writing-Master and Land-Surveyor, at Cambridge; Mr. Ross, Author of the Instructor's Assistant, at Portsmouth; Mr. Broome, School-Master, at Putney; Mr. —, Master of the Boarding School, at St. Edmund's-Bury; the Rev. Mr. Holiday, of Lincolnshire; likewise from several others, whose Letters being mislaid, their Names are forgot.

THE

## KEY

TO THE

## TUTOR'S GUIDE;

OR, THE

Arithmetician's Repository.

BOOK I. PART

### 1. NUMERATION.

NUMBERS expressed in WORDS.

NINETY-FOUR; feven hundred and fixty-two; three thousand and twenty-four; thirty-seven thousand sour hundred and fixty; one hundred forty-two thousand, six hundred and thirteen; six million, forty thousand, three hundred and ninety; forty-seven million, six hundred thirty-nine thousand, one hundred and twenty-one; seven hundred ninety million, sour hundred one thousand, nine hundred and sifty; seventy-nine million, forty-one thousand, nine hundred and sifty-sive.

Words expressed in Figures.

77, 490, 6055, 17709, 800002, 7044074, 694400060.

Roman Numerical LETTERS expressed in FIGURES.

19, 200, 600. 560, 1001, 1750, 70000, 110000, 1500000, 1600000,

Common Figures expressed in Numerical Letters.

XXIX. CIV. CCCCXIX. MDCCXLI. MMVII. XVIIDCLXXVIII. XIV. DCLXXIVLXXXIV.

#### INTEGERS.

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#### 2. ADDITION.

To add these Examples I begin with the first, and say 6 and 7 is 13, and 6 is 19, and 4 is 23, and 2 is 25, and 9 is 34; this is the Amount of the first Row, or Unit's Place, which contains 3 Tens, and 4 over; this 4 I fet under the Row, and carry 3 to the next Row, or Ten's Place, faying 3 that I carry and 4 is 7, and 1 is 8, and 9 is 17, and 1 is 18, and 4 is 22, and 7 is 29, this being 2 Tens and 9 over, therefore I fet down g and carry 2 to the next Row, or Hundred's Place, faying 2 and 7 is 9, and 4 is 13, and 1 is 14, and 9 is 23, and 2 is 25, which is 5 to fet down, and I carry 2 to the fourth Row, or Place of Thousands, saying 2 and 4 is 6, and 7 is 13, and 2 is 15, and 6 is 21, and 4 is 25, and 7 is 32, which is 2 to fet down, and I carry 3 to the fifth Row, or Place of Tens of Thousands, and find that it also amounts to 32, when I set down the odd 2, and carry 3 to the fixth and last Row, or Place of Hundreds of Thoufands, and find that it amounts to 22, and as this is the last Row, I fet down the whole 22, that is, the 2 under the Row and the two Tens I carry to the left Hand, and in the same Manner proceed with the rest of the Examples.

(1) 2222594 (2) 696237 (3) 433968 (4) 225879

(5) 2181162 (6) 326034 (7) 341780 (8) 88622054

(9) 1148103

### 3. SUBTRACTION.

When the upper Figure is greater than the lower, as in the first Example, I say o from 2 there remains 2; then 2 from 4 there remains 2, and 6 from 7 there remains 1; in this Manner proceed to the End of this Example. But when the lower Figure is larger than the top one, as in the second Example, I say 7 out of 1 I cannot have, therefore I take 7 out of 10, (which I borrow) and there remains 3, and the top Figure 1 makes 4, which I place under the Unit's Place, and carry 1 to the next lower Figure, saying that 1 I carry to 6 makes 7, then 7 from 4 I cannot, but 7 from 10, there

remains 3, and the top Figure 4 makes 7 to fet down, and 1 to carry to the next lower figure, which is 4, makes 5; then fay 5 from 9 there remains 4; but now I do not carry any to the next Figure, because I do not borrow, but only say 7 from 4 I cannot, but 7 from 10 there remains 3, and the top Figure 4 makes 7 to set down, and 1 I carry to 0 is 1, from 0 I cannot, but 1 from 10 there remains 9, and carry 1 to 8 is 9, from 7 I cannot, but 9 from 10 there remains 1, and the top Figure 7 makes 8; lastly, 1 I carry from 1, and there remains 0, which being the last Figure, I do not set it down; and in this Manner proceed with the other Examples.

(1)	221122 (	2) 897474	(3) 689796	(4) 3160990
		, 5/1/1	107 373	110.0

### 4. MULTIPLICATION.

#### CASE I.

I begin with the first Example, and say, twice 3, or 2. Times 3, is 6 to set down; then twice 5 is 10, that is 0 to set down, and carry 1; then twice 8 is 16, and 1 I carry is 17, that is 7 to set down, and I carry 1; then twice 9 is 18, and 1 I carry is 19, that is 9 to set down, and 1 to carry to the next Figure; and so I proceed to the End of this Example, and likewise with all the rest, always remembering to carry 1 for every 10 to the next Figure on the lest Hand, as in Addittion.

(1)	835219706	(2) 1028157258	(3)	1030723656

(7) 2102064752 (8) 3386617605

## CASE II.

	CASE II.	
(9) 856424376 142737396	(10) 172859776 43214944	(11) 84537943 108691641
2283798336	605009216	1171454353
(12) 1237835 1732969 990268	(13) 2858841 2541192 1905894	(14) 16241490 10827660 18948405
117594325	218860161	8120745
295356 1181424 886068 738390	(16) 47269 378152 236345 141807 330883	(17) 662229 441486 147162 515067 294324
839106396	3478100289	3478100289
(18) 4585548 6878322 2292774 5349806 764258 3057032		(19) 3339168 2086980 834792 1669584 2504376 2921771
318998232163	e (Produce de la company) Produce (Produce de la company)	318998232168
	16314384 8157192 19033448 21752512 10876256 16314384	

15359274703104

### CASE III.

(21	85968376
	10746047
	53730235
4	12984188
	12527 6064070076

(22) 7242305625 6437605000 5632904375 1609401250

166579474222305625

CASE IV.

(24) 16608 11072 5536 68092800000

### CASE V.

7=63
=132

### CASE VI.

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To perform the Examples in this Case, I begin with the last, and say, 9 times 8 is 72, put down 2 and carry 7; then 9 times 6 is 54, and 7 I carry is 61, and the Right Hand (or back) Figure 8 is 69, put down 9 and carry 6; then 9 times 7 is 63, and 6 I carry is 69, and 6 the back Figure is 75, put down 5 and carry 7; then 9 times 2 is 18 and 7 I carry is 25, and 7 the back Figure is 32, put down 2 and carry 3; then 9 times 4 is 36, and 3 I carry is 39, and 2 the back Figure is 41, put down 1 and carry 4; then 9 times 1 is 9, and 4 I carry is 13, and 4 the back Figure is 17, put down 7 and carry 1. Now as the Multiplication by the 9 (the Unit's Figure) is ended, I add the 1 I carry to the last Figure in the Multiplicand, and it makes 2, which I put down, and the Work is ended; and in this Manner proceed with all the rest of the Examples in this Case.

(33)	1569876	(34)	171312	(35)	1899222	(36)	338464
(37)	542130	(38)	2822784	(39)	248353	(40)	335286
(41)	2712592						

## 5. SECT. V. DIVISION.

#### CASE I.

In the first Example I begin and say, How oft 2 in 17? Answer, 8 times 2 is 16, and one over, which is 10, added to 4 the next Figure, makes 14; then I say, how oft 2 in 14? Ans. 7 times 2 is 14, and 0 over; how oft 2 in 2? Answer, 1 and 0 over; how oft 2 in 6? Ans. 3 times 2 is 6, and 0 over; how oft 2 in 3? Ans. 1 and 1 over, which is 10, and the next Figure 6 is 16; how oft 2 in 16? Ans. 8 times 2 is 16, and nothing remains; and in this Manner proceed with all the rest of the Examples in this Case.

(1) Quotient 8713	18 (2) 921354-	2 (3) 540185—2
Proof 17426	<del>-</del> <del>0</del> 36, (4) 215185—1	(5) 11903492-2
(6) 667751-6	(7) 346012	(8) 7.52010—4
(9) 251160-4	(10) 23040—4	

#### CASE II.

To perform this Case, I begin with the first Example, and say, How oft is 25 in 73; or, which is better, how oft 2, the first Figure in the Divisor, in 7, the first in the Dividend, and I find (after the Allowance is made for what I shall have to carry) it will only go 2 times; wherefore I place 2 in the Quotient, and multiply 25 the Divisor thereby, the Product (viz. 50) set under 73, and subtract; then to the Ramainder 23 I bring down the next Figure 6 in the Dividend; then I say (as before) how oft 2 in 23? Ans. 11 times, which I place in the Quotient, and multiply (25) the Divisor thereby, the Product, viz. 225 subtracted from 236 leaves 11, to which bring the next Figure in the Dividend, viz. 4, then proceed as before, till you have brought down all the Figures in the Dividend, and the Work will be finished.

Divifor. Divid. (11) 25)736473575(2) 50	
236 147 225	7294715 +213. 5 168
.114 Pr. 786	473575 450
147	. 30g 252
· 223.	· 577 504
· 235 225	· 732 672
107	Remains 60
· · 75 · · 75	
 (13.) 648)272357640(42030 2592	(14) 05 759)30891829676(40700697 3036
· 1315 1296	· · 5318 5313
1976	5 <sup>2</sup> 96 . 4554
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es 15 2	• 5966 5313
	Remains . 653

$\boldsymbol{\omega}_{i}$	· 9
(15) 3065)63463902247(2070600 6130	(16) 03 7489)1204530760(160848 7489
. 21689 21455	• 455 <sup>6</sup> 3 44934
18402 18390	62907 59912
9195	29956 29956
Remains 3052	•
(17) 42163)112737328(2673 84326	(18) 61745)392628787(6358 370470
· 284113 252978	221587 185235
· 311352 295141	363528
162118	54 <sup>8</sup> 037 493960

Remains.35629

Remains . 54077

## Division.

684573)3233238 2738292	9) 699(4723	47608	(20) 5)98839054780(207608 952170
4949466 4792011			3622054 3332595
· 157455 136914			· 2894597 2856510
· 205413			3808790 3808680
Remains 42	eo F	Remain	s 100
47	728395)277 23	(21) 750950 641975	255(5869
%648787(6883 w	37	089 <b>7</b> 53 827160	<b>2</b>
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72 56	3408248 352		75° 688
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. 1838 f419	Remains	1 0000
Remains 419 000		697,0000
473 000		.01
	CASE IV.	
(26)	(27)	(28)

$$16 \begin{cases} \frac{4)_{1206816}}{4)_{301704}} & 48 \begin{cases} \frac{(27)}{6)42768} \\ \frac{4)_{1206816}}{301704} & 48 \end{cases} \begin{cases} \frac{6)42768}{8)_{7128}} & 72 \begin{cases} \frac{8)_{74682}}{9)_{9335-2}} \\ \frac{9)_{9335-2}}{999335-2} \end{cases} & 18 \text{ R.} \end{cases}$$

$$144 \begin{cases} \frac{(29)}{(29)} \\ \frac{(29)}{(29)} \\ \frac{(29)}{(30)} \end{cases} & 28 \begin{cases} \frac{4)_{247684}}{300} \\ \frac{(30)}{(30)} \end{cases} \\ \frac{28}{(31)} \end{cases} \begin{cases} \frac{4)_{247684}}{8845-6=\times 4} \\ \frac{24}{(31)} \end{cases}$$

$$64 \begin{cases} \frac{8)_{14652}}{8)_{1831-4}} \end{cases} \qquad 81 \begin{cases} \frac{(32)}{9)_{417681}} \\ \frac{(32)}{9)_{46409}} \end{cases} \end{cases}$$

$$81 \begin{cases} \frac{9)_{417681}}{90} \\ \frac{1}{46409} \end{cases} \qquad \frac{1}{5156-5=5\times 9}$$

$$45 \text{ R.} \end{cases}$$

## Reduction.

$$13^{2} \begin{cases} \frac{11)307684}{27971-3} \\ \frac{2330-11}{3} \end{cases}$$
 124 Remains.

## CASE V.

(34) 17)690489(40617	(35) 86) <b>534</b> 369 <b>8</b> (62136
104	183
28	116
119	309
<b></b>	518
(36) 467)2148686(4601	Remains 2 (37) 6074)24939844(4106
. 2806	6438
486	36444
Remains 19	••••

## 6. REDUCTION.

## MONEY.

(1) 27 £.	(2) 12)6480 Pence.
540 Shillings.	2,0)54,0 Shillings.
	27 L.
6480 Pence.	

(3)	£. s. 40 10 20
	810 Shillings.
	9720 Pence.
	38880 Farthings.

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Reduction.
14
       42 Moidores.
(9)
                                (10)
                                      4)54432 grs.
        9×3=27s.=1 Moid.
                                     12)13608 d.
      378
                                      (3)1134 s.
        3
     1134 Shillings.
       12
                                            42 Moid.
    13608 Pence.
    54432 Farthings.
            WEIGHTS, MEASURES, &c.
                  TROY WEIGHT.
     24 lb.
                                    (4)138240 grs.
(1)
                            (2)
      12
                                    (6) 34560
    288 oz.
                                     2,0)576,0 dwts.
      20
                                        12)288 oz.
   5760 dwts.
     6×4=24
                                             24 lb.
  34560
      4
 138240 grs.
     lb. oz. dwt. grs.
                                      grs.
                                   (4)73942
(3)
     12 10 0 22
      12
                                   (6)18485-
    154
                                   2,0)308,0-
      20
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## APOTHECARIES WEIGHTS.

(4)	14 12	lbs.
	68	3
1	344	3
4	032	Э
806	_	rs.

(6)	2,0)8064,0 grs.
	3)4032 9
	8)1344 3
	12)168 3
	14 lb.

28377 grs.

### AVOIRDUPOISE WEIGHT.

(1,

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(14)

AVOIRDUPOISE WEIGHT.

(9) 20 C.

$$\frac{4}{80}$$
 qrs.

28

 $\frac{2240}{16}$  lb.

 $\frac{16}{35840}$  oz.

28

 $\frac{4)57344}{4)143360}$  drs.

 $\frac{16}{4}$   $\frac{4)35840}{8960}$  oz.

 $\frac{28}{4}$   $\frac{8960}{2240}$  lb.

3) 12 10 0 14 11	15 (4)7181775 drs.
20	1° (4)1792943—3 7 12
250 C.	$ \begin{array}{c}                                     $
1000 ars	16 3
1000 qrs.	(4) 28014-2

### CLOTH MEASURE.

				E.E.qrs. na. (17) 72 4 2	
(15) 24 yds. 4	(16)	4)384 nails	(17)	72 4 2	
96 qrs.		4(96		364 qrs.	
384 nails.		24 yards.		1458 nails.	
	., /.	. \ Et . II.			

### LONG MEASURE.

# Reduction.

(25) 200 Miles.	(26) 12)12672000 Inches.
352000 Yards.	3)1056000 Feet.
3	176,0)35200,0(200 Miles. 352
1056000 Feet.	00
12672000 Inches.	
Lea. m. fur. p. y.	B. C.
(27) 12 1 6 29 4	(23) 3)7193178
<b>-</b>	53)2397726 Inches.
37 Miles.	$18 \begin{cases} 3)^{2}397726 \text{ Inches.} \\ 6) \frac{799^{2}42}{799^{2}42}$
302 Fur.	11)133207 half yds.
40	4,0)1210,9—8=4 yds.
12109 Poles. 11 Half yds. in	
133207 Half Yds. 18 Inches=\frac{1}{2} Yo	3)37—6 Fur.
	Lea. 12 1 6 29 4
2397726 Inches.	
8	
7193178 Barley Corns	•
LAN	D MEASURE.
(29) 42 Acres.	(30) 4,0)672,0 Poles.
4	4)168 Roods.
168 Roode.	
40	42 Acres.

6720 Poles.

(31

(33

(3.5

(37

	A. r. p.	
(31)		)
	_4	
	51 Rood	s.
	40	
	2069	

### WINE MEASURE.

T. p. hd. gal. pts.	
(39) 4 1 1 42 6	(40) 8)9918 Pints.
<b>-</b>	(7)1239—6 Pints.
9 Pipes.	63 {7)1239—6 Pints.
-	
19 Hhds. 63	2)19—42 Gal.
<u></u>	2)9—1 Hhd.
1239 Gal.	Tuns 4 1 1 42 6
9918 Pints.	
WINCHESTER	MEASURE.
(41) 12 B. A.	(42) 4)1536 Qts.
•	(4)384 Gal.
384 Gal.	$3^2 \begin{cases} 4)3^8 4 \text{ Gal.} \\ 8) 96 \end{cases}$
1536 Quarts.	12 Barrels.
(43) 42 B. B.	(44) 8)12096 Pints.
9+4=36	(4)1512 Gal.
378	$36 \left\{ \frac{4)_{1512}}{9)} \frac{\text{Gal.}}{378} \right\}$
<u>4</u>	(9) 370
1512 Gal. 8	42 Barrels.
— <u> </u>	
12096 Pints.	
A. hds. gal. pts.	4.6) 0) 6 70
(45) 6 27 6 48	(46) 8)2526 Pints.
	18 56)315—6 Pints.
315 Gal.	$48 \begin{cases} 6)315 - 6 \text{ Pints.} \\ -8)52 - 3 \\ \hline 6 - 4 \end{cases} 27 \text{ Gal.}$ Hhds. $6 = 27 \cdot 6$
2526 Pints.	6-1 27 Gal.
-040 x miss	Hhds. 6 27 6

(

(4

(48) 8)6424 Pints.  

$$54\begin{cases} \frac{6)803}{9} & \text{Gal.} \\ \frac{9)}{133} - \frac{5}{14} \\ \frac{14}{7} \end{cases}$$
 47 Gal.  
Anf. 14 Hhds. 47 Gal.

(51) 24 Qts.

192 Bufh.

4

768 Pecks.

2

1536 Gal.

4

6144 Qts.

5784 Qts.

(54) 4)5288 Pecks.

Cha. bu. 36 26 6+6=36
216
1322 Bush.
5288 Pecks.
64 Lasts. 2+5=10
128 Weys.

(59

148

(61

	M.	d.
(59)		4
	28	
	172	Da
		V

172 Days. 
$$6 \times 4 = 24$$
103 2

M. 6 4 D.

-4	4 Reduction.		
(63)	D. h. m. " " $3^{6}554^{8}5739$ $6\times 4=24$	(94) 6,0)189341625,9 Thirds.	
	2190	6,0)3155693,7—39"	
	4	6,0)52594,8—57"	
	8765 H. 60	$_{24}$ $\left\{\begin{array}{c} 4)8765-48'\\ 6)219-5 \text{ H.} \end{array}\right.$	
5	<sup>2</sup> 5948 M.	Days 365, 5 48 57 3	
31	556937 Sec.		

# SQUARE, or SUPERFICIAL MEASURE.

(71

1893416259 Thirds.

49312 Inches.

(65)	42 Yards.	(66)	14 { 12)54432 Inches.
	9	14	14 3
	one Front		( 12)4536
	378 Feet. 12×12=144		9)378 Feet.
	4536 1 2		42 Square Yds.
	54432 Inches.		
	Sq. f. in.		Sq. in.
(67)	3 42 64	(68)	12) 4109—4 1,00)3,42—5
	100	144 -	<b>-</b>
	342 Feet.		(12) 4109—4
	342 Feet. 12×12=144		1 00 0 12 5 04 Inch.
			1,00/3,42—5
	4104		3 Sq. 42 F. 64 Inch.
	12		

## CUBIC or SOLID MEASURE.

(69) 27 Yards. 9×3=27	Inches. (70) 1728) 1259712(729 Feet. 12096
<sup>2</sup> 43 3	3456
729 Feet. 1728 Inches=1 Fe	15552 15552
15552 3456 12096 1259712 Inches.	$ \begin{array}{c} Feet. \\ 27 \\                                 $
	27 Solid Yards.
T. F. (71) 4 24 50 224 Feet. 1728 6912 3456 3456	Inches. Feet. (72) 1728)387072(5,0 224 3456 -4147 3456 -6912 6912
387072 Inches.	

END OF BOOK I.

THE

#### K E

TO THE

# TUTOR's GUIDE;

OR, THE

Arithmetician's Repository.

BOOK H. PART I. thi an

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Ro and Ter is i by : Pla pro divi rem

(1)

#### NUMERATION.

- (1) 1000000 + 500000 = 1500000 South Sea Bonds.
- (2) 60000+12000+1300=73300 Lead.
- (3) 1500000000 + 80000000 = 15080000000 Stivers.
- (4) 120206070707 Rials of Plate.
- (5) 3033030 Pieces of Eight. (6) £.404000 34 14\frac{5}{4}=£.404001 15 3\frac{7}{4}.

### ADDITION.

### INTEGERS.

(1)	140724	(2)	27460	(3) 867
	296		176	317
	42		2900	69
	6740		274	1720
	64167		1004	276842
	20		64	49
	2687		596	426074
	2684		41	60
			6104	
	217360		09510	705998
			38619	

### 7. MONEY.

To add these Examples, I begin with the first, the Farthings, going up, faying 1 and 3 is 4, and 2 is 6, and 3 is 9, and 1 is 10 Farthings, that is 25d. or 4 in 10 is 2 times and 2 over, which is 2/4 or 1/2 to put down under the Row of Farthings, and carry 2 Pence to the Unit's Place of Pence, faying 2 I carry and t is 3, and 6 is 9, and 1 is 10, and 9 is 19, and 6 is 25, and 4 is 29, and 1 is 30, then coming down the Place of Tens, faying, and 10 is 40, and 10 is 50, and to is 60, and to is 70 Pence, (which by the Pence Table are 5s. 10d.) or the 12's in 70 are 5 times and 10 over, which is 10 Pence to fet down under the Row of Pence, and carry 5 Shillings to the Unit's Place of Shillings, faying 5 I carry and 8 is 13, and 2 is 15, and 4 is 19, and 7 is 26, and 1 is 27, and 6 is 33, and 7 is 40; I fet down o, and carry 4 to the Place of Tens, faying 4 I carry and 1 is 5, and 1 is 6, and 1 is 7, and 1 is 8, and 1 is 9, Half of which (or the 2's in 9) is 4, and 1 over, which I fet down under the Place of Tens, in the Row of Shillings, and carry the Half (viz. 4) to the (Unit's) Place of Pounds, and proceed then as in Integers.

But the common Method (though not so concise nor yet fo easy) is to go up the Unit's Place, and come down the Tens, as in the Row of Pence, which (in this Example) comes to go Shillings, or the 20's in go are 4 times and 10 over, thus, 2,0)9,0(41. 10s. fo that it plainly appears to the Unit's Figure in the Divisor, or, what I stop at is, o, so that the Unit's Figure in the Dividend, or what the Unit's Row of Shillings comes to above 10, will be to fet down, and to carry I for every 10, (as in Integers) to the Place of Tens, and what that fum is, divide it by that Figure which is in the Place of Tens in the Divisor, which in this case is by 2, consequently is the Reason of my halfing the Ten's Place of Shillings: Likewise when you stop at 40, 60, or &c. proceed as above, only, instead of dividing by 2, you must divide by 4, 6, or &c. observing always to fet down what remains under the Place of Tens .- See Cafe 3. Sect. 5.

<sup>(1) £. 36 19 10</sup>½ (2) £. 227 18 9 (3) £. 472 11 3¾

	f.	s.	d.	£. s. d.	ſ.	3.	d.
(4)		1	61		(6) 276		
	60	0	104	67 10 103			101
	60	10	03	170 10 01			111
	96	6	10	100 10 64	107		A CONTRACTOR OF THE PARTY OF TH
	176	6	6±	4 16 6 2	10		
	2	2	0	0 19 03	0	14	11
4	16	17	61	37 11 111	367	17	63
	100	0	0	600 10 0	0	12	41/2
				220 0 6 5	20	10	6
	783	0	42		1000	0	0
		1 Sept. 18	-	$1463 \ 6 \ 6\frac{3}{4}$	2070		
				<del></del>	2070	4	8

WEIGHTS, MEASURES, &c.

Here I begin with the first Example, going up the Unit's Place in Grains, and find it comes up to 23, which, on a Slate, or waste Paper, I put down the 3, and carry 2 to the Place of Tens, and find it comes to 11, which I fet down to the 3, and the Whole of the Row of Grains make 113, which I divide by as many Grains as make I Penny-weight, viz. 24, and find it will go 4 times and 17 over, thus 24)113(4 times, and 17 remains; put down 17 Grains under the Row of Grains, and I carry 4 Penny-weights to the Row of Penny-weights, which I proceed with as in Shillings, as I stop at the same number, viz. 20; Likewise, wherever I stop at 4, 12, or any Number under, I proceed as in Farthings and Pence, according to what Number I stop at; but when I stop at any Number exceeding 12, as 16, 28, 54, &c. then I proceed as with the Grains above, fo that it is impossible, (without greatly perplexing the Learner) to perform these Examples before he has learned Division: And I am very forry not to fee this Method practifed more than what it is, that fo much of that precious Time of Youth should be lavished with perplexing Methods of the Teachers, as it is as improper to teach a Scholar to add these Examples before he knows the primary Rules in Integers, as it is to teach a Child to read before he knows his Letters.

1+1	07	170 dwt.		arc	77
111	UZ.	1/0 awt.	0	813.	1/

<sup>(2)</sup> lb. 114 4 0 9

(19

(21

(25

(1)

Lun

Jul

Aug Sep

Oct

No

Dec

Jan

An

(3)	3 62 5 1 I	(4)	86 lb. 9 0 0 8
(5)	Tons 731 14 0 23	(6)	lb. 121 11 11
(7)	Yards 581 0 1	(8)	Eng. E. 599 4 0
(9)	E. Fl. 575 2 1	(10)	Lea. 528 2 3 to
(11)	Yards 976 0 4 0	(12)	A. 668 o 6
(13)	Tuns 67 0 1 25 0	(14)	Pun. 155 62 2 1
(15)	Tier 127 27 7	(16)	An. 88 9 3
(17)	A. Hhds. 118 3 0	(18)	B. Hhds. 125 53 3
(19)	A. B. 1241 0 7 6	(20)	B. Fir. 125 4 0 0
(21)	Qrs. 378 4 0 0	(22)	Cha. 138 35 1
(23)	La. 78 0 2 1 0	(24)	Mo. 110 1 6 10
(25)	D. 513 18 0 0		

### APPLICATION.

(1) D.	(2)	ar da vara	
June 29	Thus, 1772+6	=1832 the Year	required.
July 31	s south	, is Children to be	
Aug. 31	(3)		£.
Sept. 30	Youngest had	11000+1100+1	1=12111
Oct. 31	Eldest	12111+100	0=13111
Nov. 30			+
Dec. 31		Left to both	25222
Jan. 27			
And the second s			

Anf. 240 Days.

### Addition.

(4) D.	(5)	£.	s.	d.
Jan. gr	Paid in Part	17	17	6
Feb. 29	Rem. unpaid	82	2	6
Mar. 31				
Apr. 30	Anfw	7. 100	0	0
May 31				
June 30	(6)	£.	s.	d.
July 31	Private Men rec.	474	17	112
Aug. 31	Besides which each	}467	_	
Sep. 30	Officer rec.	5407	G	0
Oct. 31			-	
Nov.30	Anfv	V. 942	17	112
Dec. 31			—	
Anf. 366 Days.				

(7)	£.	s.	ď.	(8)		£.	s.	d.
Corn Chandler,	123	19	0	Oats,	•	46		
Brewer,						100		
Butcher, -					-	16	16	0
Baker, -	24	0	6	Barley,		73	0	8
Tallow Chandler				Wheat,			9	
Taylor, -	137	9			-		4	
Draper, -					rriage,		2	
Coach-maker,							13	111111111111111111111111111111111111111
Wine-merchant,							18	
Confectioner,					170 3 110			
Rent 821. +825.				A	nfw. £	330	12	1
Servants Wages	, 46	1	0		. ~	-		_
Ex. on the Road								
	11.				The state of the s			

Anfw. £. 1108 14 3

F

A I B C D E F G H I 2 K 2

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	(10) £. s. d. To Merc.Wares, 418 2 6 Cheshire Cheese, 52 18 0 Broad Cloth, 317 12 10 Lead - 320 0 0 Bar Iron, - 173 0 3 Copper, - 1110 10 1 Accepted a Bill 88 14 0 Do. on Honour, 50 0 0 Morocco Skins, 28 15 4 Conv. Insur. &c. 43 0 0 Warehouse Room &c. \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
M 12 12 0	Factorage, 112 6 o
N 15 0 0	
$0 \overline{5 \times 3 + 10} = 1 5 0$	Answ. L. 2720 4 0
0 5 ^ 3 7 105. — 1 5 0	~ <u>-′</u> -
Anfw. £. 76 2 10\frac{3}{4}  (11)	
$(13) \qquad M. \ f. \ p.$	(14) Years. m. d.
From hence to B, 39 6 o	28 0 0
thence to C, 46 0 24	
D, 60 4 39	1 11 0
E, 37 6 o	
	16 9 27
From A to E is 184 1 23	Answ. Years 53 0 12

(15) Thus, 16+14=30 Years older. (16) Thus, 17+29+23=69th Year, his Age red	uited.
	Years.
Then 19 Years and 19 Half Years=19+9=	24 28±
The Youngest is now	21
Answ. Father's Age.	721

than lowe the f canı ther whi whic mai

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mai and with

he n feen fees it, a to t dow 3 to fet d to fe

(1)

(4)

Ren

(

A. 167 Sheep at first.

When	Seth was born		-	130 Years old.
	Enos	Seth	_	105
	Caipan	Enos		90
	Mahaleel	Cainan	_	
	Jared	Mahaleel	-	70 65
	Enoch	Jared	_	162
	Mathufelah	Enoch		65
	Lamech	Mathuselah		187
	Noah	Lamech	_	182
And w	hen the Flood	happened No	oah was	600

Anfw. 1656 Years.

#### SUBTRACTION.

#### INTEGERS.

(1) From	476004	(2) 276000	(3) 40106 27109
Take	120706	106019	
Remains	355298	169981	12997

#### 8. MONEY.

As the upper Figures in the first Example are all larger than those which are underneath, so it is only taking the lower Line from the upper without borrowing at all; but in the second Example I begin and say, 2 Farthings from 1 I cannot, but 2 Farthings from a Penny, or 4 Farthings, there remains 2, and 1 the top Farthing makes 3 Farthings, which I set down thus, \(\frac{3}{4}\); then I carry 1 to 11 is 12 Pence, which from 10 Pence I cannot, but 12 from 12 there remains 0, but 10 the upper Figure is to put down, and carry 1 to 11 is 12, from 10 I cannot, but 12 from 20 there remains 8, and the top Figure 10 is 18 Shillings to put down, and carry one to the Unit's Place of Pounds, which proceed with as in Integers.

Note. When the Learner is pretty ready at fubtracting, he need not make use of the Words I cannot, as it is always seen at Sight whether he can or cannot; so that when he sees the lower Figure is greater than that which stands over it, always take the lower Figure from what you borrow, and to the Remainder add the top Figure, and their Sum set down; thus, in the 2d Example, I say 2 from 4, 2 and 1 is \frac{3}{4} to set down, and carry 1 to 11 is 12, from 12 0, but 10 to set down, and carry 1 to 11 is 12, from 20, 8, and 10 is 18

to fet down, and carry 1, &c.

			d.	(3)	£. 87	s. 7	d. 5½
$(4)$ 77 14 $5^{\frac{3}{4}}$ (5)	10	9	113	(6)	103	12	114
(7) £. s. d. Paid 370 17 1			(8) Re	ceived	£.	s.	d. 9
Rem. unpaid 105 2 11			Rem	. un pai	d 26	9	9
(9) f. s. d. Borrowed 2648 19 10 4 Paid 1843 14 3							
Bal. 805 5 74		•					

#### WEIGHTS, MEASURES, &c.

-	1 2								2.4							- 20
- 1	.1	lh a			00	(0)	07	0	TO	77	(0) 1	0	^	-	-	
	1)	lb. 2	10	17	20	(2)	04.	.3	13	1	(3)1	0. 3	U		U	14
										C 180						1 1 1 1 1

#### APPLICATION.

(1) Thus, 1789—1735=54 Years old.

2) First, 102—72=30 Diff. and 102+72=174 Sum.
(3) f. s. d.
(4) f. s. d.
A's Sum 74 17 0
Borrowed 100 0 0
Diff. 49 13 6
Paid 41 17 0

Anf. B's Sum £. 25 3 6 Anf. Rem. £. 58 2 6

(5) Income —	£.	s. 0	d.
King's Tax — Repairs —	140	0	0 16
Pays in all —	234	17	6
Anf. neat Income	365	2	6

To

Н,

A

Fir Int

An

Sec Int

Pa Th Int

A

		Sub	trac	tion.	7		3	5
(6)					£.	5.	d.	
Left to both	h.			a salak sa		10	6	
		000	+1	1100+11=		0	0	
Daughter,						2.4		
	A	nfv	v. th	e Son had £	. 1000	10	6	
(7)					£.	5.	d.	
Value of bo	th.				35	10	0	
Ditto Horse				•	12	12	0	
Ditto Furn					22	18	-0	
Ditto Lain			Anf	Difference,		6	0	
(8)			•	, Dinoconce,	Ž. 10	Ü	_	
	<i>(</i> .	s.	d.	Cr.	£		s.	d.
To A, -	71	12	6	By Cash,		3 1	13	6
В, -	34	9	8	Commod				0
С, -	16	8	8	Housh. I	urnit. 1	3	8	6
	44	0	0	Plate	•		8	5
	66	7	6	Teneme	nt, g	6 1	5	0
	11	2	3	Book De	bts, &	7 1	13	10
G, -	19	19	0		_	- /2 - //	-	-
H, 135. 4d. ×30=	20	0	0	C	r. £. 19	2 1	19	3
Dr. 2		19	8					-
Cr. I	100	1	3					
Anf. Bal. loft f.		0	5					
-			_					
	£.	5.	d.				s.	d.
First Bond,	114	10	. 0	Altog. are v	vorth	50	0	0
Interest,	19	0	0				16	6
-			_					_
Amount, £.	133	10	0	Chaise,	£.	11	3	6
Paid off,		0	0					—
_			-	Chaife & H	arness	13	13	0
Second Bond,	91	10	0	Chaife	•	11	3	6
Interest,	13	4	8					_
-			—	Harnels,	£	. 2	9	6
	104	14	8					_
Paid off,	37	14	. 2	Horfe & H	arness	38	16	0
				Harnefs,		2	9	6
Third Bond,	67	0	6			-		_
Interest,	9	11	3	Horfe,	£	. 36	7	0
-						-		—
Anf. Amt. £.	75	11	9					

## Sultraction.

Jar Ma

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3 <sup>0</sup>	•	uou	action.			
(11) C. qrs. Grofs 12 0 Tare 1 3  Net { 10 0	19 26	first	Grot Tare nd } Venture. N	s 8	I	2
170	15	iecor	nd J N	et 7	0	15
Anfw. C. 3 o	6 D	iffer	ence.			
(12) A.	Dr.			C		
1784. Jan. 21, To Cash	£. s.	d.	1784. Jan. 11, By Cash,	£.		
Feb. 29, Ditto,	5 6	8	Feb. 24, Ditto,	12	0	
	12 2	6	Mar. 24, Ditto,	11	18	
	5 5	-				
•			Cr.	71	15	4
£.	32 4	2		32		2
			Bal. to A. L.	39	I 1	0
В.	Dr.		Per Contra,		Cr.	
1784.	f. s.	d.	1784.	L.	s.	d.
Jan. 24, To Cash,			Jan. 11, By Cash,	34	11	6
Mar. 2, Ditto,	6 6	0	Feb. 12, Ditto,			0
19, Ditto,			Mar. 14, Ditto,		8	8
			24, Ditto,	11	18	*4
£.	18 1	0	Cr.	80		6
			Dr.			0
			<b>J</b>		•	_
			Bal. to B, £.	62	11	6
				-	1	_

							01
C.	1.00	Dr.		Per Contra;		Cr.	
1784.	£.	s.	d.	1784.	£.	5.	d.
Jan. 30, T	o Cash, 19	8	4	Jan. 11, By Ca	fh, 28	18	10
Mar. 19, D	itto, 5	5	0	21, Ditto		5	
		_		Mar. 2, Ditto		0	
	£. 24	13	4	24, Ditto			4
To A.	- 39	11	2		Cr. 74	2	2
В.	- 62	11	6		Dr. 24	13	4
C.	- 49	8	10				
				Bal. to C.	£. 49	8	10
Jointly,	£. 151	II	6				_
(13) Sto	ck. D	r.		Per Contra.		Cr	
(13) 515		s.	d.		f.		d.
To D. E.	- 713		0	By Brandy,	874		6
M. F.	- 352		4 12 2	Claret,	754		
L. P.	- 180		0	Corn,	675		
I. B.	- 57			Canary Seed,	113		300
Infuran	nce, 190		0	Indigo,	632		
2.3	·			Saffron,	253	5	
	£. 1494	8	6	W. P.	384		
	~			Wines p. F. G	. 1011	10	
				Pepper p. S. Q		16	
				Bond on R. O.	300	0	0
				Note on T. M			0
				India Bonds,		0	0
				Interest,	25	14	6
				Bank Stock,	2134	4	6
				Banker,	1892		6
				Cr.	11024	15	
				Dr.	1494	8	6
				An. Pref. Worth	0530	7	5

## Subtraction.

Stock, To Debts, &c.	£.		(1 d. o	Per Contra,  By Cash, &c.  By Trade he cleared  Cr.	£. 1505 393	10	
				Anf. Bal. £.		3	1
Factor,			(1	5) Per Contra,	,	Cr.	
E. lanes	123	3 15 3 5 7 13	6 6 7 6 11 8	Oil, Raifins, Wool, Commission	£. 226 150 104 136 193 143 75 , 71	16 11 6 10 17 0 13 18	d. 6 3 0 0 0 4 8 11 - 8 -
He was to ferve Of which he accomplished	Y. m	11	. d.	h. m.	0 0		0

Jun Jul

Jun July

178 Jun

July

Jun July

			Su	ıbtra	Etion.			39
(17)	W.		Dr.		Per Contra,		Cr	1 100
1784.	4				1784.	£.	s.	d.
June 30,	To Cash, 6	66	3	0	June 4, By Cash,		18	2
	Ditto,				Note,		0	0
	Ditto,				24, Ditto,	14		10
		700			July 15, Ditto,	52	0	0
	£. s	92	3	9	-			—
				-	Cr.	314	11	0
					Dr.	92	3	9
					B. due to W. f.	222	7	3
X.			Dr		Per Contra,		Cr	
1784.			٠.		1784.			
	To Cash,	17	10	8		33	14	9
July 7.	Ditto.	7	3	ī	Cash,	66	5	3
19.	Ditto,	28	18	10	July 24, Ditto,	19		o
								_
	£.	93	12	7		119		0
				-	Dr.	93	12	7
					Bal. due to X. £	. 26	. 6	5
Y.		D	r.		Per Contra,	Cr.		
1784.					1784.			
	To Cash,			6	June 4, By Bal.	116	14	10
	Ditto,			4	14, Ditto,			0
July 12,	Ditto,	81	19	8	28, Ditto,		5	0
	£. 2			6	July 15, Ditto,	42		0
	7.2	14	5	_		296	10	10
						214		6
					Bal. due to Y. £	. 82	14	4
7					Per Contra,	Cr.		
Z.	ם	r.			1784.	٠		
1784.	To Cash,				June 4, By Cash,	70	8	0
		11	8	0	July 15, Ditto,	31	12	4
July 7,	Ditto,	12	O	3	Affignment,	63	4	8
	f.	22	10	3	•			
	~'.	-3	- 3	3	Cr.	165	5	0
					Dr.			_3
T	E 2				Bal. due to Z. f.		5	0
•								-

#### Subtraction.

	£.	s.	d.
To W.	222	7	3
X. —	26	6	5
Y. ( -		14	
z. —		I have been	-
Jointly	1. £. 472	13	9

1	ALTERNATION OF STREET	Feet.
(18)	Had at first, — — — — — — — — — — — — — — — — — — —	127
e 3 8 d	Answer, remains -	28

- (19) Thus 42-14=28 the Difference required.
- (20) Now 134-93=41 Son's Age, And 112-41=71 Father's.
- (21) First, 25—14=11 Diff. of their Ages. Then 25+11=36 C's Age.
- (22) Now, 1789+13=A. D. 1802, B. born. Then, 1802-1693=109 Years, A. older than B.

	lb.
(23) In fair Weather, — — —	339°5 3°624
- foul,	30624

Answer, 3281

Hip

Befo

Pek From

Rem

From

Gra

Goe

Con

Goe

Con

Goe

Con

Goe

(24) Year Before Christ 200 Since - +1782	) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (	Years. 50 +1784	Years. 1784 —140
Hip. and Arch. 3 1984	Passido Passido	nius 1834 and Ptolem	y 1644 Y.
	lb. 20000 94600	Nankin Bell, - Erford Bell, -	lb. 50000 25400
Rem. Erford Bell,	25400	Answer, Differen	ce 24600
(26) Grandfather's Age, From which take Leaves your Age	Years. 119 83	Father's Age is From which take Answer, Differ	Years. 65 36 rence 29
(27) Goes up the first Day, Comes down at Night,	Feet. 8 4		Forfalted
Goes up the fecond Da	-	Feet made good the f	irlt Day.
Comes down at Night,	4	84 oas A. A. ba	Homenla
Goes up the third Day	, 8 8 —	made good the fecon	d Day.
Comes down at Night,	16		
Goes up the fourth Day	12	made good the third	Day.
	20	the fourth Day at Nig	ht, Anf.

## Subtraction.

	First, 1784 then 37+2 and 61+1 also 78+1	4=61 $7=78$	C's A's Ag	'e•		
(29)	Conquest, To which a		•	Anno	1066	
	Edifice finis	hed		Anno	1210	
50000	The Peace From which			Anno	1713	
codyc auna Transit	Demolition From whic			Anno	1643	
39 88	Answer, Du	ıration	, (c) -		433 Y	ars.
(30) Revolution, Forfeited be	Anno	1688	Forfeited Granted		Anno	Years. 0 1551 1239
Forfeited in	Anno	1551		Anfwe	r, fublist	ed 40
Mofes born To which ad	Anno	(31 2433 832	) Christ be From wh	orn nich tal	Anno ke	4000
Homer born			Cæfar b From wl			3960 312
ond Day.	ool all barg	201.23	Alexand	er bori	n Anno	3648
Then 3960 4000 3648	<b>}</b> -3265=	$\begin{cases} 695 \\ 735 \\ 383 \end{cases}$	From H	lomer	to Cæfa — Chri — Alexa	ft. ander.
	Answer	, 1813	Years, S	Sum of	the Inte	ervals.
San A. total						

(32)

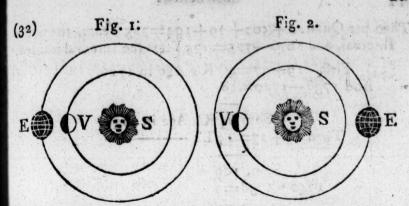
S Fig. whee Find And The F

Wh

Ebe

Fro She

Ebe



Suppose S. the Sun; V. Venus; and E. the Earth; then Fig. 1, will represent them when in Perigæo, and Fig. 2, when they are in Apogæo.

Fig. 1, or the Distance the Earth is from Venus, when in Perigeo.

And 81000000 + 59000000 = 140000000 = V S + S E = V E Fig. 2, or the Distance the Earth is from Venus, when in Apogæo.

Therefore 140000000—22000000=118000000 Miles the Answer.

(33) First 23+8=31 A.'s And 31+19=50 B.'s Age.
Also 50+14=36 C.'s Now 31+50+36=117 the Sum.
Then 117-22=95 D's Age.

(34)When Selah was born Arphaxad was 35 Years old. - Eber - Selah 30 -- Peleg Seber 34 430 Years. Eber lived after the Birth of Peleg From the Birth of Arphaxad to the Death 529 of Eber was Shem died after the Birth of Arphaxad, 500 Eber was the Survivor by 29 Years.

C. born

Lived before D.

D. born Anno

Then per Quest. 2+500+29+194=725 Years, the whole Interval, and 1000-725=275 Years the Interval wanted. (35) First 19+27=46 K's Age in 1720. And 1738-1720=18 Sum 64 K's Age in 1738. Then 18+27=45 L's -Sum, 109 1740-1738=2 Sum, 111-24=87 Years the Age of [M. in 1740. First 318+207=525 B. (36)Then 525-104=421 C. Flourished. And 421- 84=337 D. Then 337+112=449 E. Alfo 449+ 47=496 F. Sam was born before Toby 28 Years. (37) Toby died at 12 - old. After which Sam lived 19 Sam's Age, 59 Years. From which deduct 16+11=27 32 Years. Leaves Rachel's Age To which add 7+4=11 Gives Joshua's Age 43 Years. Then 12+59+32+43=146, the Sum of their Age. (38)Years. Z. born A. D. B. born A. D. 1108 1527 After which Y was born 74 Lived before C. 48

1156

113

Y born Anno

1269 X. born Anno

Tro 1601 Lon Before which X was bo. 114

1487

(39

(40

(41)

(42

Ten

Tro

Lon

-A. D. 3143 2817

I shall be 34+17=51 !	Years of Age.
The Reformation, Anno From which deduct	1517 215
Invention of the Compass, Anno To which add	1302
Gunpowder invented, Anno To which add	1344
America discovered, Anno	1492
The Reformation, From which deduct	1517
Printing invented, Anno	1440
Restoration, Anno Grant made before	1660
First Grant made, Anno Duration,	1627
First Grant ended, Anno Reversionary Grant's Continuar	1837 nce, 99
Its Expiration, Anno -	1936
When B. is 41 A. will be 41—18 But when A. is 72, B. will be 72	8=23 Years old. +18=90 Years old
	orn A. D. 4000 uilt before, 744
built, Anno 2557 on after 260 Carthag	A. D. 3256 e built before, 113
	And you will be 70-34=36 The Reformation, Anno From which deduct  Invention of the Compass, Anno To which add  Gunpowder invented, Anno To which add  America discovered, Anno The Reformation, From which deduct  Printing invented, Anno Restoration, Anno Grant made before  First Grant made, Anno Duration,  First Grant ended, Anno Reversionary Grant's Continual Its Expiration, Anno When B. is 41 A. will be 41—12 But when A. is 72, B. will be 72  (43) Debuilt, Anno Built, Anno Duration  Ochrist before  443 Rome below the Anno Christ before  Anno Christ before  443 Rome below the Anno Christ before  443 Rome below the Anno Christ before

2817

London built,

London older than Carthage by 326

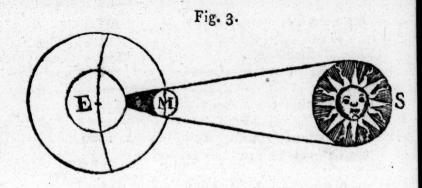
London built, Anno

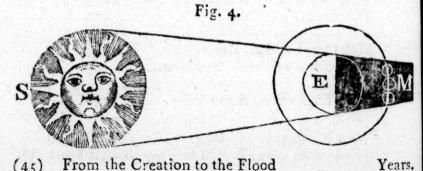
Suppose E the Earth, M the Moon, and S the Sun; then the Eclipse of the Sun will be represented by Fig. 3, and that of the Moon by Fig. 4.

Therefore 81000000—240000=80760000=S M Fig. 3, or the Distance these two Luminaries are asunder, in an

Eclipse of the Sun.

Likewise 81000000+240000=81240000=S M Fig. 4, or the Distance the two Luminaries are asunder, in an Eclipse of the Moon.





보는 것이 그렇게 되는 것이 되는 점점을 통해 없어요. 이번 전에 발생된 내일에 하는 사람들이 되었다면 하는 것이 없는 것이 없는데 되었다면 하는데 하는데 되었다면 없는데 없다면 없는데 없다면 없다.	656 630
Together 4 Mahomet after Christ,	622

Answer, Christ born, A. D.

Wh

Whe

Year To A

Afte

Mils Left

Left

Anfr

The And

(4

4000

			n Adam	was	-		The state of the s	arsold.
	Enos		Seth				105	
	Cana		Enos				90	
	Maha		Canaai				70	
	Jared		Mahai	eel			65	
	Enoc		Jared				163	
		uſelah	Enoch				65	
	Lame		Methu				187	
	Noah		Lamec		-		182	
When t	the Fl	ood hap	pened N	oah wa	as	_	600 Ye	ars.
		Flood,		•	•	Í	656	
To Ada	am's l	Death 13	0-1-800=	=	•		930	
Aster h	is De	ath,	•	•			726 Ye	ars.
Left by	itty's y the l	Father,	£. 13200	By F	ather	•	lotte,	13200
Lett by	, the C	randm)	+1800 +1800	Бу	Fland	шош	iei, Ł	. 1800
Answei	r, left	them,	£.8600					
(4		Reform: To which	ation was h add	in Ar	no		1517 88	
		Powder To whi	Plot was ch add	discov	ered	-	1605	
Then I	1714-	-54=1	narles mu 660 King 12 Years	Charl	les the	e II.		d.

(49) First 180— 47=133 Years since B. died.
And 161—133= 28 Years B.'s Age.
Then 47+ 43= 90— C.'s Age.
Sum, 118— the Answer,

# Subtraction.

(50) First,	1789+28=1817	I. D.
And,	1817-50=1767	
Alfo,	1767-26=1741	Timothy.
Likewise,	1741-17=1724	Sampson.

(51)	Firft,	1733-	445=1	288 A. b	orn.
	Then,	1362-	1288=	74 A.'s	)
	And,	37+	18=	74 A.'s 55 B.'s	Age.
	Alfo,	256—	197=	59 C.'s	)
	Again,	1733-	75=1	658 D. di	ied.
	Then,	1658—	1578=	80 D.'s	Age.

(52)	Reformation, Anno From which deduct		1517 23
	A. died Anno - born -		1494 1441
			53 A.'s Age.
	Then 1517+49=Anno And 1494-7=-	•	1566 B. died. 1487 B. born.
	Alfo, 36—7+9= Then, 52+70+20=152	the Ani	79 B.'s A.

(53)	Anno	A. D.
	1438, lived 48 Years; then 1438-	-48=1486 died.
B. died	1502, bo. bef. 77 Yrs 1502-	-77=1425 born.
C. in	1577, was 22 Yrs. old, 1577-	-22=1535
	1577+54=1631 died.	
D. died	1648, and in 1616 had lived & 1	is Time; then
	1648-1616=32 Half his Age dou	ble of which is 64
Then	1684, born bef. 64 Yrs. then 1648-	-64=1584 born
E. in	1648 was 13 Yrs. old, 1648-	-13=1635 born.
And in	1635+13+14+31+7=1700 die	ed.
F. in	1635 bornafter 27 Yrs. then 1635+	-27=1662 born.
C :		

(

(1)

(4)

Proc

Prod

(7)

Prod.

(54) Ann	no Anno	
	1727—42=1685 A. died 1685—47=1638 — born	Aged 47 Years
	1638+13=1651 B. born 1712-8=1704 — died	Aged 53 —
	1638—17=1621 C. born 1712 — died	Aged 91 —
	1621-23=1598 D. born 1598+64=1662 — died	Aged 64
	1704+11=1715 E. born 1733+12=1745 — died	Aged 30 —
	1638—1598=40 Half of v	which is 20.
	1638—20=1618 F. born 1745—14=1731 — died	

The Sum of all their Ages is 398 Years. Then 113—91=22 Years F. survivor.

#### MULTIPLICATION.

#### INTEGERS.

(1) 14276084 4	(2) 20749509 9	(3)1204674
Prod. 57104336	186745581	14456088
(4) 4074746	(5) 147624	(6) 42768
16	69	748
Prod. 65195936	10186056	31990464
(7) 10646 5278	(8) 14276 89674	(9) 3142708 467852
Prod. 56189588	566386024	1470322223216

(5)

(7)

(10)	27680709 40700609	(11) 2142760 4100	(12) 21700 954000
Prod. 11266	21713851781	8785316000	20701800000
(13) Mul. By	46904 (14 9×3=27	) Mul. 10709 By 8	×7×6=336
Prod. 126	66408	3598224	
The a	bove Examples are	performed as in	Sect. 4.

### CONTRACTIONS.

### EXAMPLES.

(2) Thus, 2746400000 27464
9)2746372536
Prod. 305152504
(4) 476940000 47694
9)476892306
529 <sup>88</sup> 034
Prod. 370916238

£. 7 10 4

			1	Ta.	· · P·	Heen								
(5)	747600000							Thus	hus, 427630000 42763					
		3)74	752	524	•		3)427587237							
	Pro	d. 24	1917	508	0				1 42-5	290	79			
								Prod	. 2850	581	58			
(7)		4276					(8) 1	<b>M</b> ul. 6	946 486					
	2 51	5656 312=	=6>	<b>\2</b> =	=12			3384	676 108=6	×8				
	53	877					Prod	3978	756					
	CO	MPC	UN		MUI 10N		PLIC	ATIO	N.					
The second secon	s. 17			(2)		s.	d. 0½ 6	(3)	£.	s. 6	d. 4 9			
Prod. 29	15	10			843	0	3		155	17	•			
(4)			s. 17	d. 64 4				(3)	£.	s. o	d. 6 5			
		£.3	10	2				. 6	£. 15	2	6			
(6)			s. 7	d. 10				(7)		s. 18	d. 9₹ 8			

F 2

£. 2 14 10

(21

(23

(25

(27)

(29)

1

(31)

(15) 
$$\begin{array}{c} s. d. \\ 4 & 1 & \frac{1}{2} \\ 6 \times 5 = 30 \end{array}$$
 (16)  $\begin{array}{c} s. d. \\ 10 & 8 \\ 6 \times 6 = 36 \end{array}$ 

(17) 
$$d.$$
  $f.$  s. d.  $2\frac{1}{2}$  (18) 1 7 0  $0 \times 5 = 45$ 

s. d. £. s. d.  

$$27\frac{1}{2}$$
 (20) I II 0  
 $8\times7=56$   $8\times8=64$   
£. 99 4 0

(21)	s. d. 15 9 9×8=7	(22)	d· 11 } 10×8=80
	£.56 14 0	£.3 1	8 4
(23)	s. 9 12×7=84		s. d. 1 10 <del>1</del> 12×8=96
£	. 37 16	£. 9	2.0
(25)	s. d. 18 11½ 11×9=	(26)	s. d. 11 10 10×10=100
	£. 93 16 10½	£. 59	3 4
(27)	s. d. 1 6 12×10=	(28)	s. d. 1 10 12×11=131
,	£.9 0 0	£. 12	8.0
(29)	s. d.  1 $7\frac{3}{4}$ 12×12=14	(30) £. 4	s. d. 10½ 4×4+1=17
£. i	117 0	£.21 2	104
(31)	s. d. 19 11 <sup>3</sup> / <sub>4</sub> 6×3+1=	(32)	s. d. 1 7½ 7×4+1=29
· £.	18 19 71	£. 2 7	1 2

F 3

(44

£.

£.

Der nati

(1)

(3)

(5)

#### WEIGHTS, MEASURES, &c.

Proceed here in the like Manner with the Product of each Denomination, as you did with the Sum of each Denomination in Addition.

### Multiplication.

	vá.	f	in.	b.c.	И	7.hd	5.00	tote		Т	,, ,	1.1		
(8)	147	2	11	6	(9)	46	47	7 3	(10	6) 6	#. P	. na 1	46	gr. 3
	887	2	10	0		40	17	5		55	0	r	59	0
(11)	Tier 27	.g. 41	qts. 2 6	(	B.,	hds.	g. 47	pts. 6 5	(1	3)	1.hds	.gal.	q. 3	p. 1 4
-	167	39	0			43	51	6			41	23	2	0
14)	В	.b. 12	fi.g. 27	p. 7 6	(1	5)	A. 14	. r.	p. 26 5	(1	6)	La. 74	7	u.p. 1 1 7
		76	1 2	2			70	3 1	10			523	2 .	5 3
`			(1	7)	D. 365			8 57	,					
					4382	2 2	1 4	7 24	1					

#### APPLICATION.

- (1) Now, 54×54=2916. And 46×19=874. Then 2916—874=2042, The Number required.

  For 2916—2042=874 Proof.

  Thus, 142×50=7100l. the Sum required.

  Now, 12×12×6=864=Six Dozen Dozen.
- (2) (3) 12×6= 72 Half a Dozen Dozen. And

792 Difference. Answer, 936 Sum.

(4)

The The And

1 He add ther in t Yea

(7) Eac Hat Tov

```
(5)
(4)
                           First 28X2
      52 Counties.
                           And 8 \times 2 + 20 = 36
       7×6=42
                           Answ. Difference 20
     364
                                   55×2=
                           Again
    2184 Parishes.
                           And
                                     5 \times 2 + 50 = 60
     246
                                 Answ. Difference 50
   13104
   52416=6×4=24
  537265 Houses.
       10
  5372640 Persons.
```

```
(6) Years. £.

The first 4 he cleared 364 per Ann. =364×4=1456

The next 3 _____ 586 =586×3=1758

And the last 3 _____ 873 =873×3=2619
```

His whole Gain, £. 5833

Then 13000-5833=7167 his original Stock.

To find the State of his Fortune at each Year's End, thus: He began with 7167£. cleared the first Year 364£. which, added to 7167£.=7531£. his Worth at the first Year's end; then 7531+364=7895£. at the second Year's End; and in this Manner proceed by a continual adding the preceding Years' Gain.

```
(8) C. qrs. lb.
C. qrs. 137 2 10 Gr. Wt.
13 1×3=39 3 0 Tare.

Answ. C. 97 3 10 Net Weight.
```

To the Widow, - 1250×	4=50	80	0
Relations, 31l. 10s.×5×3(1 —— Charity,			0
Gained by Trade, $126 \times \frac{5 \times 5 + \frac{1}{2}(25)}{5 \times 5 + \frac{1}{2}(25)}$	A A STATE OF THE S		15.00
Answer, begun with	£. 41	89	10
(10) Income,	£.		
Expends, 19s. $\overline{11d.\times9\times8\times5+5}(365)=$			
Answer, lays u	136	10	5
(11) Expends, f. 11. 125. 6d.×9×8×5+5(365) Lays up	£. =593 294	s. 2 12	d. 6 6

(12) First 20+423+19=462 the Divisor. Then 423×462+20=195446, the Dividend.

Answer, Income 887 15

Rent Repair	£. s. 7 7 0 18 0 8	6 per Quar.
Sum	8 14	9
Anf. £.	34 19	o per Ann.

```
d.
(14)
                                                5000
    Widow,
                                                            0
    Charity,
                                                  846 10
                                      £.
                                                            0
                                     1230×3=3690
    Nephew,
                                     1050×4=4200
                                                            0
    Nieces,
                          51. 55. \times 5 \times 4(20) = 105
200 Guin. = 210
    House-keepers,
                                                            0
    Executor,
                     Answer, died worth, £. 14051 10
```

(15)

£. s. d.
100 0 0
1 7 0
0 10 6

In each Division was 101 17 6
× 6

In each Drawer was 611 5 0
× 12

Answer, £. 7335 0 0

#### Multiplication.

(16)

Yards. 73726 at one Circumvolution.

3

221178 in a Minute.

60

13270680 in an Hour.

10

132706800 in a Day.

365-63= 302 Days worked.

2654136 3981204

Answer, 40077453600 Yards.

(17) First 20× 60=1200 Feet, Piers stand on. And 21×170=3570— Arches Span.

Width of the Danube, 4770
Thames, 1200

Answer, 3570 Feet the Difference.

(18)
Now 187 is the leffer Number.
And 187 +34=221 the greater.
Then 221 × 187=41327 their Product.
Also, 41327 × 41327=1707920929 Square of Ditto.
Likewise, 187+221=408 their Sum.
And 408 × 408=166464 Square of Ditto.
Also, 34 × 34=1156 Ditto of their Difference.
And, lastly, 1707920929+166464+1156=1708088549 the Sum of those Squares.

(19)

(20)

Wan

12

(19) First 109×73=7957 the greater Number. And 28×17= 476 Difference.

7481 leffer Number.

Then 7957+7481=15438 their Sum. And 7957 × 7481=59526317 their Product. Acres.

(21) One comes up 6 Ways. (20) A. had 757 В. 2104 C. 16410 36 D. 12881 Two comes up E. 11008 F. 9813 13800 Three comes up [216 H. 8818 416 Wanted,

Four comes up 1296 the Ans.

Sum, 76007= of the Whole.

5

Answer, 380035 Acres.

(22) f. s. d. 100 G.=105 0 Ten Marks= 6 13 4 £. s. d. W. had 98 8 98 6 8 -0 16 R. 97 10 97 10 0 0 0 T. 91 4 0 91 +3 17 S. 95 95 Answer, £. 382 1 10

### DIVISION.

### INTEGERS.

(1)	4)14076893	(2)	12)30742165
	3519223—I	kasar isib ti Abasartan	2561847—1
(3)	89)2410296(2708	187 uot. Rem	
(4) (5) (6)	576)98420649(176 3029)308763705( 46058)162212124	0869—10 <i>5</i> 101935—2	590
(7) (8)	127345)51799555 3090807)7885599	(406—9748 4985(2551)	35 3—23599 <b>4</b>
(0) (11)	37,00)12764214,2 827,000)4074964 93,00)247698514	478(4927-	-3354 <b>78</b>
(12)	$4 \begin{cases} 2 \\ 7 \end{cases} \frac{67402}{33701}$	(13)	$\begin{cases} 7 \\ 9 \end{cases} \frac{701747}{100249-4}$
	4814-6		$\frac{1}{11138-7}$
(14)	(4) 4170642	(15)	(6) 2741724
112	${}_{2}\left\{ \begin{array}{l} 4\\4\\7 \end{array} \right\} \frac{\frac{4170642}{1042660}}{\frac{260665}{1}}$	-2 336	${                                    $
	260665 37237—		$\frac{65279-1}{8159-30}$

### EXAMPLES.

(16)	4681	7823 677
	4681	1504

he I So (17)

(18)

(19)

in 17 which or 71 over, Penc over, Man

Then 1504 the Sum of the Overplusses, divided by 999 he Divisor gives 1, and 505 remains.

So 4681 + \frac{505}{995}, = \text{the Quotient required.}

(17) First, 2692464

\times 9

Then 4599 \div 9=511, the Remainder, 2423 | 2176 So 2423 \div 11 \div 1 \div 1

Then  $5670 \div 9 = 630$ , and  $630 \div 1111$ 10000)4292 1378 = 1741, the Remainder; fo the Quo-4292 tient is  $613\frac{174}{7777}$ .

7)4292 5670

613-1

(19) 109494 9 10000)98|5446

> 6)98 Then 5446÷9=605, and 6+11+2222 =2838 the Remainder, : 16<sup>2838</sup>/<sub>6666</sub> is 16-2 the Quotient required.

# (10) COMPOUND DIVISION. MONEY.

Here, in the 3d Example, I divide by 8, faying the 8's in 17 is 2 Times and 1 over, the 8's in 11 is 1 and 3 over, which is 3£. this 3£. I carry to the 11s. and it is 3£. 11s. or 71s. then I fay the 8's in 71 is 8 times 8 is 64. and 7s. over, which I carry to the 4 Pence, and is 7s. 4d. or 88 Pence; then I fay the 8's in 88 is 11 Times, and nothing over, and fo the Quotient is £.21 8s. 11d. in the fame Manner proceed with all the rest.

(20

R

Answ.

64	Division.	
(1) f. s. d. 2)14 16 10½	(2) f. s. d. 7)267 0 0	(3) £. s. 8)171 11
Quot. 7 8 53	38 2 104 7	21 8
(4) £. s. d. 9)317 0 6	(5) L. s. d. 11)6 6 11½	(6) £. s. 3)7 11
Quot. 35 4 6	0 11 6 2	2 10
(7) £. s. d. 10)3 17 1	(8) £. s. d.	(9) £. s. (54)45 12
Qu. £. 0 7 8½	£. 1 4 6	$16 \begin{cases} 4)45 & 12 \\ 4)11 & 8 \end{cases}$
24 \{ \frac{4}{6} \)o 18 3	$36 \begin{cases} 6)64 & 19 & 0 \\ 6)10 & 16 & 6 \end{cases} $	${2} \begin{cases} (12) & f. & s. \\ 6) & 190 & 4 \end{cases}$
$f \cdot \circ 3 \circ \frac{1}{2}$	£.1 16 1	£.4 10
$ \begin{array}{c} (13) \\ 48 \\ 8 \\ 6 \end{array} $ (13)	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	f. s. d.
		2 9 3 4
(15) L. s d.	(16) f. s. (	17) £ s. d

Divi	sion.		1		05
(18) £. s. d. 81 \ 9)121 12 6	(19)	£. 10)174	s. 1	d. 8	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	120 {	12) 17	9	2 0\frac{2}{3}	
(20) £. s. d. 17)214 17 9 <sup>±</sup> / <sub>4</sub> (20£.	(21)	£. 145)476 435	5.	d. 0(3	£.
Rem. 10 £.		41 20			
17)217(125.	) :-: f	145(820 725			
47 Rem. 13d.		95			
12 17)165)9d.	Í	1015			
Rem. 12d.		145)500			
17)49(½ qrs. Rem. 15		435			
17 An	fw. L. 3		) <del>1 4 5</del>		
Anfw. $f$ . 12 12 $9\frac{1}{2}$ ) $\frac{15}{17}$ (23) $f$ . $s$ . (23)	(5)	£.			
112 4) 7 10 6 7) 1 17 7½		201 16 ) 28 16	6 <del>3</del>		
£. 0 5 4½		£. 2 17		44.7	
G 3_					

(5)

Qu

(8)

(11

Qu

(14

Qu

(1) (2)

(3) (4)

(5) (6)

An Th

(24) £. (25) 8)1426 224 7)152 12 8).178 8) 21 16 5 71 10) 22 £. 2 14 6 63 f. 2 4 (26) L. s d. £. s. (27) (5)12 12 11 10 (3)1061 64 (5) 2 10 27) 353 16 35 50 10 10 0 10 14 per Qr. 4 £.2 0 £. 101 5 1  $9^{\frac{1}{2}}$ (28) d. £. s. 8 ( 5)450 13 112 27) 90 94-3 35  $6 - \frac{1}{4} \frac{33}{35}$ 12 17 £. 51 10 1 327 WEIGHTS, MEASURES, &c. lb. oz. dwt.grs. (2) T. C. grs. lb. (1) 2)8 1 15 8 3)24 14 0 14 8 Quot. 4 0 17 16 4 2 23 3 1b. 3 3 9 grs. C. grs. lb. oz. drs. (4) 5)4 11 (3) 4)17 2 27 14 15 23 0 11 Quot. 4 1 20 15 113 7 1

Yds. qr. na. E.E. qr. Lea. m. fu. p. (5) 9)214 3 2 (6) 8)120 4 (7) 9)12 2 0 26
Quot. 23 3 2 15 0 2 1 1 1 34
Yds. f. in. b.c. W.hhds.gal. Tu. p. hd. g. qt.
(8) 10) 147 2 11 2 (9) 11) 24 57 (10) 8) 10 1 1 60 3
14 2 4 2 3 2 16 5 1 1 0 1 31 0 8
Tier.g. pts. Hhds. gal. B.hhds.g. qts.
(11) 6)16 20 7 (12) 5)76 27 (13) 4)12 49 2
Quot. 2 31 35 15 15 3 12 11
B.b. fi. g. A. r. p. La.qr.bu.j.
(14) 3)61 2 6 (15) 12)140 2 26 (16) 7)60 6 7 2
Quot. 20 2 2 11 2 35 2 8 6 5 24
D. h. m. sec.

6)146 23 24 56 Quot. 24 11 54 91

### APPLICATION.

Thus, 22,0000 -1,0000=221. each Person. (1)

Thus, 336 -12=28 Miles per Day. (2)

First, 4429 ÷ 43=103, then 240-103=137 the Ans. First, 2262 ÷ 26=87, and 2262 ÷ 87=26. (3)

(4) Then, 87-26=61, the Number required.
5190048 - 72084=72 the Number required.

(5) (6) First, 419844+3=139948 the Remainder.

And 419844×9394=3986998936 Pro. of Div. and Quot. Then 3985998936+139948=3986138884 the Answer.

### Division.

(7) First,	360—144=216 the greater Number. 216—144=72 their Difference.
Alfo -	261×144=31104 Product.
Likewise	216:144=1-72 or 12 the larger Quot.

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- (8) First 3 Tons=3×20=60 Cwt. then 60÷15=4 Cwt. per Man. the Answer.
- (9) First, 22525÷25=901 and 9696÷16=606. Then 1440+901=2341, and 2341-606=1735 the Ans.
- (10) First 134×71=9514, consequently 9514÷57=16652 the Answer.
- (11) Fourscore and thirteen Millions=93000000.

  Then 93000000 ÷ 30079=3091, and the Remainder is 25811, from which deduct 21180, leaves 4631 Excess, the Answer.

(12) 2,0) 1640 Guineas +82 £. 1722 o College. £. 1722  $\times 4$ £. 6888 6888 o Wife. -1383 5505 o Daughter. 2)5505 +2752 10 8257 10 Eldeft Son. f. 8257 10 o Sum of the ? 2)12393 - Mo.& Sift. 6196 10 Youngest Son. £. 6196 10 988 10 Expences on his Burial. 29557 10 died worth.

Then from 30000 take 29557 leaves £.442 10s.

```
(13)
```

s. d.
8)12 8 Worth of both.
1 7 Ditto of the Purse.

Answer, L. 11 1 Cash in Ditto.

(14) £. 3. Brother owed at first 74 18 Paid in Part, - —41 14	d. 2 8
Remains on Balance, 2)33 3 Half of which is +16 11	6 33 3 6 Bro.
Sister owed at first, 49 15 Paid in Part, - 13 12	3 10 114 115 111
Remains on Balance, 36 2 To which add the Brother's, 33 3	
Uncle William owed, 69 5 Paid in Part,24 7	
Rem. on B. unpaid by him, 44 18	8 44 18 8 Uncle.
All together owed,	£. 114 4 7
Then from 150l. take £. 114 4	7 leaves £. 35 15 5
(15)  C. qrs. lb.  Weight together, 9 3 16  Difference, —1 2 16	£. s. d. Coft, 97 17 6 Diff. 8 13 3
2)8 1 0 Rem.	2)89 4 3
Lesser Weight, 4 0 14 Difference, +1 2 16	Coft, £. 44 12 1½ Diff. 8 13 3
Greater Weight, 5 3 2	Coft, £.53 5 42

Firf

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(16) In Cash 10000 Bills, f. 54 10 6×8=436 Left in all, £. 10436

Debts, &c. 36+260=296

o Neat. 9)10140 4 Daughter had, f. 1226 13  $9\frac{1}{4})\frac{1}{3}$ 

7)9013 10  $2\frac{1}{2}$   $\frac{2}{3}$ 

Sons had each, £. 1287 12 10115

(17) First, 2072-14=148 Elms in each Row; then 148-1= 147 Vacancies, and 147 × 25=3675 Feet, or 1225 Yards, the Length of the Grove required.

(18)(19) First 129+178=307 Then 1000—307=693 And 693÷ 3=231 B.'s Alfo 231+129=360A.'s And 693÷ 3=231 B.'s Alfo 231+129=360A.'s Likewife 231+178=409 C.'s

An.inRank 12 Men.

(20) First 37-28=9, then 250-9=241. ...3)241

gives  $80\frac{1}{3}$  B.'s And  $80+37=117\frac{1}{3}$  A.'s Alfo  $80-28=52\frac{1}{3}$  C.'s

207+213+289+234+522+220=1315 the Sum. (21) which being divided by 5, the Times each being men-5)1315 tioned, viz.

Quotient, To which add Fourscore and 13=	263 93
Sum, From which deduct	356 I
Leaves, Answer,	355

(22)
First 10000—8500=1500 O.'s
And 8500—60;0=2450 L.'s
Then 6050—420=5630, and 5630=2=2815 M.'s
Confequently 2815+420=3235 N.'s

3341 the Sum of those Squares.

Again, 11×11×14=1331 the Cube of their Difference.

First 7050 ÷ 94=75 the lesser Number.

And 7050×7050=49702500 the Square of the greater.

Also 75 ×75 = ....5625 Ditto of the lesser.

49696875 Difference of those Squares.

Again 7050+75=7125 their Sum, and 7050-75=6975 the Difference; then 7125×6975=49696875 the Product of their Sum and Difference.

Confequently 49696875 × 49695875=2460779384765623. the Square of the Product of their Sum and Difference.

(25) Suppose the Expence or Profit to be 2.

Then 2×2=4 double the Expence.

And 2÷2=1 Half the Profit.

Answer, Difference 3, or as 4 to 1.

(26) First B. is to have 72 And C. 72+112=184 more than A.

Sum, 256

Then 1500—256=1244
... 3)1244

gives  $414\frac{2}{3}$  A.'s And  $414\frac{2}{3} + 72 = 486\frac{2}{3}$  B.'s Also  $486\frac{2}{3} + 112 = 598\frac{2}{3}$  C.'s (27) First 25000+33000+33000+28000+32000= 148000 their Sum; then each being repeated 4 Times, that Sum must be divided by 4, viz.

4)148000

Which gives 37000 £. Sum of their Fortune, then

From Take Rem.

25000=12000£. the Youngest's Fortune.

33000= 4000 — Eldest's.

30000= 7000 — Second's.

28000= 9000 — Fourth's.

32000= 5000 — Mils Charlotte's Fortune.

Proof, 37000 £.

(28)

First 120 at 2 for 1d.=120÷2=60 or 5 0

And 120 at 3 = 120÷3=40 = 3 4

8 4 Cost.

Then 240 at 5 for 2d.=240÷5=48 } 8 o Sold for

Difference o 4 Lost.

(29)
A. and B. had
B. and C.
A. and C.
Sum, £. 37 18 6

Which being divided by the Number of Players at each Time will give the Sum won, viz.

£. 37 18  $6 \div 2 = 18$  19 3 what was won. £. s. d. 2 = 18 19 3 what was won. Then from 18 19 3 = 12 12 0 = 12 = (30)

Sold

T

(3.1)

Wor

Wor

Wor

L.	. s.
	10
	10
W. Y. and Z. 378	3 4
They being mentioned 311473 each 3 Times.	4 Sum.
Sold for 450 Guineas, or 472	1 4 joint Proper
Answer, lost L. 18	8 11 <b>4</b>
(31) Worth at the End of 31	Years, 3179 11. 8. 0 £.= 25 0 0
ad a lad bikk ad las - a k 1 4/100	TANKE CONTRACTOR
3½ Years=13 Quarters,	13)3204 11 8
or a feet and a second of the	-246 10 1±
Worth at the End of 3 Years, f.	2958 1 64
	+ 100 0 0
it officially a second of	
Comments Com	4)3058 1 64
San State Co.	- 764 10 4±
Worth at the End of 2 Years,	£. 2293 II 2
	£ 100 0 0
in making contours	
	4)2393 11 2
	- 598 7 9 <del>1</del>
Worth at 1 Year's End,	£. 1795 3 4±
	+ 100 0 0
199 Jan 199 - 199	
14000 (41	4)1895 3 4½
Manager Manager (1997)	<b>—</b> 473 15 10
Answer, he began with,	£. 1421 7 6±

(32) £. First, 10:5=2 £. each Man's Share, supposing they had attended equally.

(5

(7)

(9)

(11)

And 2 £. -7=5s. 84d. each Man's daily Pay.

Then 55. 84d. ×2=115. 51d. what C and D. must each forfeit.

And f. 1 2 10 $\frac{2}{7}d$ .  $\times 2 = f$ . 1 2 10 $\frac{2}{7}d$ . C. and D.'s whole Defaults. And f. 1 2 10 $\frac{2}{7}d$ .  $\div 3 = 7s$ .  $7\frac{3}{7}d$ . what A. B. and E. each received of C. and D.'s Default.

Alfo 55. 8\frac{4}{d} \div 4 = 15.5\frac{1}{7}d. what A. B. C. and D. each received of E.'s Default.

Therefore,  $2f. +7s. 7\frac{3}{7}d. +1s. 5\frac{1}{7}d. = 2$  9 0 A A. Ditto, 2 9 0 B B. 2  $f. +1s. 5\frac{1}{7}d.$  lefs 11s.  $f. +1s. 5\frac{1}{7}d.$  lefs 11s.  $f. +1s. 5\frac{1}{7}d.$  lefs 11s.  $f. +1s. 5\frac{1}{7}d.$  Alfo,  $f. +1s. 5\frac{1}{7}d.$  lefs 5s.  $f. +1s. 5\frac{1}{7}d.$  lefs 5s.  $f. +1s. 5\frac{1}{7}d.$  lefs 5s.  $f. +1s. 5\frac{1}{7}d.$ 

(33) First 12—1=11, and 11×2=22 she had before she met the last Boy; then 22—2+10=30 she had before she met the second Boy; consequently 30—10=20 what she had before the first returned her back 10; so that 20 being multiplied by 2=40, the Number of Apples she had at first.

(L) REDUCTION. MONEY.

(1) 130£. (2) 4)24000 Qrs.

20
12)6000 Pence.

2,0)500 Shillings.

25£.

124800 Farthings.

77567 Farthings.

£. 110	6₹	(6) 2)20553 Half-pence
20		12)102762
2200		20856
12		2,0)85,6—4
26406		£. 42 16 4½

(7) £.107 10 8 (8) 6)5348 Twopences.

2,0)89,1 2 over=4d.

6 Twopences=1s. £.44 11 4

(9) £.6 17 0 (10) 4)2782 Threepences.

2,0) 69,5—2 or 6d.

137
4 Threepences=1s.
£. 34 15 6

548 Threepences.

(11) £. 10 10 8 (12) 3)3859 Fourpences.

20
2,0)128,6 4

£. 64 6 4

263 Fourpences.

H 2

Any Number of Pounds, &c. may be reduced to Sixpences, Fourpences, Threepences, or Twopences, by multiplying the Pounds by as many of each Denomination that make one Pound; that is, to reduce Pounds, &c. to Sixpences, multiply by 40, if to Fourpences by 60, if to Threepences by 80, and if to Twopences by 120, observing to add in the odd Shillings and Pence, if any; accordingly, on the contrary, any Number of Sixpences, Fourpences, &c. may be reduced to Pounds, by dividing by as many as make one Pound, observing to value the Remainder (if any) right; thus, the two last Examples.

(15)	21 Guineas.	(16) 4)24192 Farthings.
	7×3=21	12)6048
	3	3)504
	441 Shillings.	$21 \left\{ \frac{3)504}{7)168} \right\}$
	5292 Pence.	24 Guineas.

21168 Farthings.

(21

(1

(10

(23)

60 Crowns,

6000 Pence. H 3

2,0)40,0 Shillings.

20 £.

78	Red	duction.	
(25)	A Crown=60 Half do.=30	£.213 15 6	
	Shilling =12	4275	*
	One of each 102	12	
		102)51306(503 of each.	
		306	
(26)	120 £. 8 2)960 Half Crowns.	(27) A Crown=5 o Half do.=2 6 Shilling =1 o Groat =0 4	
	480 Crowns.	Sum, 1 of each=8 10 6×6=	=3
	3)7200 Groats.	2 13 —	
- 1 fu	2400 Shillings.	£. 15 18 —	

 $\frac{27}{9}$   $\frac{9417}{3139}$  Shillings.

348 Moidores, and 21 Shillings over.

Scook Pen

240 Guineas 7×3=21	(30) £. s. 21 Guineas=22 1 A Crown = 0 5 A Moidore= 1 7
3 5)5040 Shillings.	In each Purse, 23 13 7×3=21
4)1008 Crowns.	165 11 3
252 £.	Answer, £. 496 13

- (31) First, 4s. 3d.=17 Threepences. And 1178×17=20026 Ditto. Then, 2002,6:8,0=£.250 6 6 the Answer.
- (32) First, 17s. 6d.=35 Sixpences.
  And, 1£.=40 Ditto.
  Then, 470 Pistoles.
  7×5=35

  3290
  5
  4,0)1645,0

Answ. £. 411.55.

(33) First, 5s. 3d.=21 Three-ds. And, £. 249 7s. 6d.=19950 Ditto. Then, 19950 - 21=950 Q. Guin.

Bobao Grains

AFERXS

(3)

(5)

2450 Florins.

(35) First, 5s. 4d.=32 Twopences, and 18s. 6d.=111
Ditto. Now, 474×111=52614 Ditto. Therefore
52614÷32=1644 Crs. 1s. the Answer.
(36) Moidpres.

$$\begin{array}{c}
1240 \\
9 \times 3 = 27 \\
\hline
11160 \\
3 \\
21 \\
\hline
3)33480 \\
7)11160 \\
\hline
Anfw. 1594 Gu. 6s.$$

# WEIGHTS, MEASURES, &c.

(1) 14 lbs.  
12 24 
$$\{4\}$$
 138240 grs.  
24  $\{6\}$  34560  $\{6\}$  3460  $\{6\}$  3470  $\{$ 

80640 Grains.

A.103768 grs.

4

(7)			lb. oz. dwt. grs.			
	f Dishes, each Weig Plates,	ght —			15	
One of each		•	3	5	10	22
	Answer	, lb.	41	6	11	0

(11)

(13)

(15)

oz. dwt. grs.	oz. dwt. grs.
Bowls, each 24 4 0	455 1 16
Tankards, - 11 14 0	20
Tea Pots, - 10 10 0	<del></del>
Lamps, - 20 17 21	9101
Pl. per Dozen, 127 11 0	6×4=24
Spoons, ditto, 36 17 23	
· .	54606
One of each, 231 14 20	4
20	
and the second s	218440 grs.
4634	
$^{4^{6}34}_{6\times 4=24}$	
27804	and the second of the second
4	
Total Action Action Control of the C	
111236)218440(1 of each.	

Rem. 107208 grs.=223 oz. 6 dwts. 20 grs.

Answer, 1 of each Sort and 223 oz. 6 dwts. 20 grs. over.

(9)	4 10	9 grs. 4 1 12	(10) grs. 2,0)5993,4
	12		3)2996—14 grs.
	5 <sup>8</sup>		8) 998—29
	468		12) 124-63
3	3		16. 10 4 6 2 14
	1405 20		
	28112 Gra	ins.	and the strategic of th

(11) 6 Tons.
reo Cwts.
480 qrs. 7×4=28
3360
13440 lb.

$$\begin{array}{c}
(14) & oz. \\
16 & 4) & 29768 \\
4) & 7442 \\
28 & 4) & 1860 \\
\hline
7) & 465 \\
\hline
4) & 66 \\
\hline
C. & 16 & 2 & 12 & 8
\end{array}$$
C. 16 2 12 8

(15) lb. oz. drs. 67 12 15 16 1084 16 (16) C. qrs. lb. 6 3 27  $\frac{4}{27}$   $\frac{7}{189}$  $\frac{4}{783}$  lbs. in 1 Hhd.

Answer, 4698

(24

(26

(28)

Anf.

(30)

(17) C. qrs. (18) C. 507 C.  
11 2 A Fother=
$$19\frac{1}{2}$$
 2  
 $\frac{4}{-}$  39)1014(26 Fother,  
 $\frac{7}{3^{22}}$   $\frac{4}{1283}$  12880(10 Answer.

(19) C. qrs. lb. (20) lb. C. qrs. 
$$\frac{12 \ 3 \ 12}{51}$$
  $\frac{2}{51}$   $\frac{4}{35}$   $\frac{2}{253}$   $\frac{4}{35}$   $\frac{7}{245}$   $\frac{4}{12}$   $\frac{4}{12}$   $\frac{4}{12}$   $\frac{4}{980}$  lb.

253)1960(7 Parcels, and
Remains 189 half-lbs.=3 qrs. 10½lb. over

2

3)240

80 lb. great.

(21) 
$$6+8+12+16=42$$
 lb. One of each.  
C. qrs. lb. (22)  
4 3 24 . 24 lb. great.  
 $\frac{4}{19}$   $\frac{3}{2)72}$   
 $\frac{28}{36}$  lb. common.  
 $\frac{3}{556}$  (23)  
 $\frac{2}{7}$  185-2 . 120 lb. common.

20 lbs.

Ans. 26 of each, 20lb.

	v	1.	700	
(24)		ls.	100	
		7	3	
		4		
	11	1		
		4		
			T-:	1_
	44	41	vai	18

864 Otalia i allega.

(26) E.Eng. qrs. na.

30 4 3

5

154

(28) 24 Yards.

4
96
4
384 N.=1 Piece.

619 Nails.

Anf. 5376 Nails.

(30) E. Fl.

20 each.

3
60 qrs. in 1 Piece.

12
5)720

144 Ells English.

Answ

Answ. 12 Ps. in 11 Yds.

(38) First

whice 5622 Anfo

(40)

86	Reduc	lion.
(32)	24 E. Fl. 3	(33) 60 Miles.
<b>\</b>	72 Qrs. in 1 Piece.	480 Furlongs.
	864 Qrs. in 12 Pieces.	19200 Poles.
5	3456 Qrs. in 4 Bales.	
E.Eng	g.691—1 Qr.	
(34)	8)320	(35) 16 Miles. 1760 Yards in 1 Mile. 28160 Yards.
	Anfw. 40 Miles.	3 84480 Feet. 12 1013760 Inches. 3 3041280 Barley Corns.

(37) 276 Miles.
1656 4692
485760 Yards. 6×6=36
2914560
17487360 Inches 3 52462080 B.C.

	Reduction.	87
(38) Feet.  First 18\(\frac{1}{2} = 37\) Half-Ft.  Miles.  197  1760  1182	(39) M. fur. 69 4=1° 8 556 11×20=200	Yds. in 1 Fur.
3349 346720 Yards. 6 2080320 Half-Ft	6116 20 122320 Yards in 1 6×6=36	
which divide by 37= 5622437 Times, the Answer.	733920 6 4403520 Inches in	2.4
2-1 5-18-2 Pm	13210560 Bar. C. in 6×60=360° 79263360 60 5801600 Barley Corr	(46) (34) 4 (4)
(40) 64 Acres.		5,0 Poles, 1aA
256 Roods. 40 10240 Poles	Anfw.  1	136 Acres

Anin: 40 Day.

(42) 774 Acres.	(43) A. r.
	Rents 200 0
3096	- July 90 2
4,0	Rem. 103 2
and the <del>first of the first of </del>	<b>4</b>
270 {3,0)12384,0	
9)4128	414
Answer, 458 & 180 Pc	oles over. Anf. 16560 Perches
(44) 12 Tierces.	(45) 8)6048 Pts.
42	the contract of the contract o
	(6) 756
504 Gal.	$4^{2} \begin{cases} 6) & 756 \\ 7) & 126 \end{cases}$
4032 Pts.	18 Tierces.
(46) Hhd. gal. qts.	(47) 8)5746 Pts.
4 42 2	
63	60 (7) 718—2 Pts.
294 27100 2 116% -	$63 \begin{cases} 7) & 718-2 \text{ Pts.} \\ 9) & 102-4 \\ \hline & 11-3 \end{cases} \begin{cases} 25 \text{ Gal.} \end{cases}$
4	25 Gal.
<u></u>	11-3
Anf. 1178 Qts.	
· ·	Answ. 11 hds. 25 gal. 2 pts.
(48) (41)	A Tun=252 Gal.
(48) Gal. (49) A Pipe=126 A Quart	t=4 Half Pts. 4
4 A Pint	
Half-Pt.	그리고 가게 하는 이 이 집에 가장되었다면 하면 하지만 하는 것이 되었다면 하는데
12)504 Gal.	- 4
Answ. 42 Doz.	7)4032=Half-Pts.
	Anfw. 576 of each.
그리다 얼마난 전에 내가를 하고 있었다. 이번 일이 하는 때 없을까요?	

A F A F A F A T

(52)

(54)

(56)

An

(50) 10 (61)	(51) . 12 A. Bar.(83)
A Pipe = 126 Gal.	1 1 32 100
A Punch. = 84	A 21h0,55 64
A Hogfh. = 63 A Tierce = 42	384 Gal. 144 A
A Herce 42	
Sum, 315)1890(6 of each.	3072 Pints.
li Della i	and the second second
(52) 8)1704 Pts.	(58) B.bar. fir. gal.
6)1704 Fts.	6 2 7
32)213(6 Bar. 21 Gal.	
——atomical (ra)	00) 10)8360 <b>82</b> 11.
Rem. 21 Gal.	9
· · · · · · · · · · · · · · · · · · ·	Anfw. 241 Gal.
	—— (11. (0)
(54) A.hds.gal.pts.	(55) 4)2017 Qrs.
10 42 4	26) Least Ot
	$48 \left\{ \begin{array}{l} 6) & 504 - 1 \text{ Qt.} \\ 8) & 84 \end{array} \right.$
522	1 (8) 84
8	<del>1 (1 )</del>
o n.	Hhds. 10 24 1
4180 Pints.	Anima e to Peter
(56) 12 B. Hhds.	(57) 18 A. Bar.
3	1) 2 4 5 6 6
2)36 Half Barrels.	3)36 Half Barrels.
Answer, 18 Barrels.	Anfw. 12 Hhds.

(58) T. b. 1	d. gal. (59) 24 Qrs.
Gal. 4 1	1 49
A Hhd.=54 2	P. G
A Bar. $= 36 - 4$ A Fir. $= 9 - 9$	192 Bush.
— y y	
Sum, 99 —	768 Pecks.
<b>— 19</b>	
_ 54	1536 Gal.
99)1075(10 of	
	Gal. over.
Rem. 85 Gal.	
(60) 2)3360 Gal.	(61) La. qrs. bu.
	42 4 7
4)1680	IO
8) 420	And Ore
0) 420	424 Qrs.
Answ. 52 qrs. 4 B	ufh.
(6.) (1 GL-1/1/6	3399 Bushels.
(62) 40 Chal.	(63) —— Bufb
30 (8.)	36
1440 Bush.	$3^{6} \begin{cases} 6)_{47} & 62 \text{ Bufh.} \\ 6)_{793} & -4 \\ \hline & 132 - 1 \end{cases} \text{ to Bufh.}$
4 35 05 .55 1	- to Bulh.
Answ. 5760 Pecks.	132—1 )
2/	Cha. 132 10
	<b>76</b>
(64) Cha. bu.	(65) 12)6450 Sacks.
$^{47}_{6\times 6=36}$	Answ. 537 Ch. 6 Sacks.
<u> </u>	
282	Charles and the sound
6	
3)1722	
<del></del>	
Answ. 574 Sacks.	

(66)

Anf

(68)

An

	91
(66) D. H. 365 6 6×4=24 2190 4 8766	(67) $6,0)207360,0$ Sec. $6,0)3456,0$ $24\begin{cases} 4)576\\ 6)144 \end{cases}$
60	Answer, 24 Days.
Answ.525960 Minutes.	70-6
(68) D. h. m. sec.  27 7 43 5  6×4=24  162  4  655 60  39343 60  Anf. 2360585 Seconds.	(69) D. h. m. sec. " $ \begin{array}{r} 365 & 5 & 48 & 57 & 39 \\ 6 \times 4 = 24 \end{array} $ $ \begin{array}{r} 2190 \\ 4 \\ 8765 \\ 6 \\ \hline 525948 \\ 6 \\ \hline 6 \\ 31556937 \\ 6 \\ \hline 6 \\ \end{array} $
	Anfw. 1893416259 Thirds.
(70) 6,0	)3155760,0 Sec.
6,0)	52596,0
24	${ \begin{cases} 4)^{8766} \\ 6)^{2191} - 2 \\ \hline 365 - 1 \end{cases} } 6 \text{ Hours.}$

Anfw. 365 D. 6 H.

## Reduction.

(71) D. h. 
$$3^{6}5$$
 6  $6 \times 4 = 24$ 

4

8766 Hours in I Year. 1784 Years fince.

35064 70128 149022

Answer, 651606 Days.

(72) Years.
London built 1108 before the Birth of our Saviour.
1789 fince

In all, 2897 Then 365 d. 6 h.=8766 by last Ex.

61362 78894

Nu

mo

Sed

as :

122724=2×14=28

 ${}_{24} \left\{ {}_{6}^{4} \right\} \frac{{}_{13122702}}{{}_{3280675} - 2}$ 

Answer, 546779 Days, 6 H.

### 12. THE RULE OF THREE DIRECT.

Anfw. 18s. 6d.

Or wherever the first and second Torms consist of any Numbers that are in the Multiplication Table; then the most expeditious Way will be to multiply and divide as in Sect. 9 and 10. — Thus the last Example will be performed as follows.

(2) 
$$\frac{1b}{1}$$
,  $s$ ,  $d$ ,  $\frac{1b}{1}$ ,  $\frac{1b}{1}$ ,  $s$ ,  $d$ ,  $\frac{1b}{1}$ ,  $\frac{1b$ 

But in Teaching I would advise the Tutor to follow the general Rule, to make the Pupil perfect therein, after which he will, with more Ease both to himself and Master, learn the Abbreviations.

(3) Stated thus—If 4:2::6 or 72 Or, as 4: 30d.::72:540 Pence.

Or, as 4: 30d.:: 72: 540 Pence.
For 72×30=2160, this: 4=540 Pence, which : by 12
and 20, will give £. 2 5s. the Answer.

Or,  $2s. \overline{6 \times 9 \times 8} \div 4 = f. 2 5.$ C. s. C.

(4) Stated thus—If 1: 26:: 40

Then  $26 \times 40 \div 20 = 1040 \div 20 = 52 f$ . the Answer. Or thus, £. 1 6s.  $\times 8 \times 5(40) = 52 f$ .

(5). Stated thus—If 1 oz.:  $7\frac{1}{2}$ :: 1 Cwt. or 112 Or, as 1: 15:: 1292: 26880 Halfpence.

For by Reduction  $7\frac{1}{2}d.=15$  Halfpence and  $112lb.=1792 \alpha_s$  confequently  $1792 \times 15 = 26880$  Halfpence, which divide by 2, 12, and 20, will give 56 f. the Answer.

(6) Stated thus—If 1:5 4:36

Or, as 1: 16:: 36: 576 Fourpences.

For by Reduction 5s. 4d.=16 Fourpences; these × by 36

(the third Term)=576 Fourpences, which ÷ by 60

will give £.9 12s. the Answer.

Or thus, 5s.  $4d. \times 6 + 6(36) = f. 9$  12s.

Yd. s. d. Ps. Yds

(7) Stated thus—If 1: 17 6:: 12 each 30

Or 30 1: 25 :: 260: 12600 Sixpenses

Or, as 1: 35:: 360: 12600 Sixpences.

For by Reduction 17s. 6d.= 35 Sixpences, and 12×30=
360 Yards, confequently 360×35=12600 Sixpences,
these ÷ by 40 will give 315£. the Answer.

Or thus, 17s. 6d.  $+10\times6\times6(360)=315$ f. lb. s. d. C. lb.

(8) Stated thus—If 1:7 9:: 1 or 112
Or, as 1:31:: 112:3427 Threepences.

For by Reduction 7s. 9d.=31 Threepences, these × by 112 (the last Term)=3472 ditto, which ÷ by 80, will give £. 43 8s. the Answer.

Or thus, 7s. 9d.  $\times 4 \times 7 \times 4(112) = £$ . 43 8s. First. Cost  $f_{-24}$  6s. gained 6f. which added toge

(9) First, Cost £.34 6s. gained 6£. which added together, =£. 40 6—to be fold for—then

For

(10)

For

(11)

For

(12

For

(13

Fo

C. grs. lb. f. s. lb.

Stated thus-If 2 1 14:40 6:1

Or, as 266lbs.: 806s.:: 1lb. 35.: 0 118

For by Reduction 2C. 19r. 14tb=26tlb. and £.40 6s.=806s. which : by 266 will give 3s. 0\frac{1}{2}6\frac{1}{6}6 the Answer.

(10) First, Cost gof. lost £. 7 10; Difference £. 82 10 fold for. Then,

Yds. £. s. El. Eng.
Stated thus—If 200: 82 10:: 1

Or, as 800 Qrs.: 1600s. :: 5 Qrs.: 10s. 33d.

For by Reduction 200 Yards=800 Qrs. and £. 82 10=
1650s. which × by 5 (the last Term)=8250s. these

by 8,00 (the last Term) will give 10s. 3\frac{3}{4}d. the
Answer.

(11) Doz. lb. f. s. lb. Stated thus—If 9 or 108: 2 5:: 4
Or, as 108: 45s. :: 4: 15. 8d.

For  $45 \times 4 = 180s$ , these  $\div$  108 will give 1s. 8d. the Answer. Or thus,  $45 \times 2 \div 9 \times 12(108) = 1s$ . 8d.

lb. d. Hhs. C. qrs. lb.
Stated thus—If 1:  $6\frac{1}{2}$ :: 4 each 12 2 24
Or, as 1: 13 Halfpence:: 5696: 74048

For by Reduction 6\frac{1}{6}d.=13 Halfpence, and 12 C. 2 qrs. 24lb.=1424lb. in one Hogshead, which X by 4 the Number of Hhds.=5696lb. these X by 13 (the second Term)=7408 Halfpence, which \(\frac{1}{2}\), 2, 12, and 20, will give £.154 5s. 4d. the Answer.

(13)

Coft, - - 579 12

Freight, - - 46 0

Loading, &c. - 6 0

Cuftom, - 10 0

Cellar, - 4 0

Gain, - - 360 0

Tuns.—Tuns.

Stated thus-If 46: 1005 12:: 26

Or, as 46 - 20112s. :: 26 : 11367s.  $7\frac{3}{4}d$ .  $\frac{34}{46}$ . For by Reduction £.1005 12s.=201121s. there × by 26 (the third Term)=522912s. which ÷ by 46 (the first Term) will give 11367s  $7\frac{3}{4}d$ .  $\frac{14}{46}$ , or £. 568 7s.  $7\frac{3}{4}d$ .  $\frac{14}{46}$  the Answer.

C. lb. s. d. C. qrs. lb.
Stated thus—If 1 or 112: 32 6:: 12 2 14
Or, as 112: 390d.:: 1414: 4923 d.

For by Reduction 32s. 6d.=390d. and 12 C. 2 qrs. 14ll. =1414lb. which × by 390d.=551460d. these ÷ by 112 (the first Term) will give 4923\frac{1}{4}d. or £.2010s. 3\frac{3}{4}d. the Answer.

(15) First Cost £. 89 16s. 4d. Lost £. 12 Difference; £. 77 16s. 4d. sold for—then Stated thus—If 1 or 112: 77 16 4:: 1 Or, as 112: 18676d. :: 1: 1663d.

For by Reduction £.77 16s. 4d.=18676d. which ÷ by 112 will give 166\frac{1}{4}d. or 13s. 10\frac{3}{4}d. the Answer.

Orthus, £.77 16s. 4d.÷4×7×4(112)=13s. 10\frac{3}{4}d.

(16) Here, as he fpends as much in 4 Months as he gains in 3, confequently he will fpend in 8 Months what he gains in 6——then

Spends £. 277 18 3 Gains 370 11 opr.An Spends 227 18 3 Anfw. 92 12 9

(17) First 4s. 6d. × by 12×6×0+8(36 Doz. 8 Prs.) will give 99£. the Value of the 36 Dozen 8 Pair of Stockings;

s. d. P. f.
Stated thus—If 1 4:1::99
As 4:1::5940:1485

For by Reduction 13. 4d.=4 Fourpences, and 99£.=5940 ditto, which ÷ by 4 (the first Term) will give 1485 Pair; these ÷ 12, will give 123 Dozen and 9 Pair, the Answer.

(18) First 18s. 9d. ÷ by 5=3s. 9d. fold for per Yard, and 6s. 6d. ÷2=3(. 3d. cost per Yard; then from 3s. 9d. take 3s. 3d. remains 6d. gained per Yard; and he gained as much as 180 Yards cost; thus, cost per Yard 3s. 3s. or 39d.; consequently 39×180=7020d. his whole Gain—then

(19)

For '

(20)

For

(21)

(22)

For 1

For 7

For b

d. Yd. d.
Stated thus—If 6:1::7020
6)7020

Answer, 1170 Yards.

s. d. Ell. qrs. £. s.

Stated thus—If 6 6: 1 or 5:: 23 8

Or as 12: 5 grs. :: 936: 360 grs.

Or as 13: 5 qrs.:: 936: 360 qrs.

For by Reduction 6s. 6d.=13 Sixpences, and 23f. 8s.

=936 Ditto, which multiplied by 5 (the fecond Term)

=468 qrs. thefe ÷ by 13 (the first Term) will give
360 qrs. bought; this ÷ 60, (the Quarters contained in 20 Ells. Fl. or 1 Piece) gives 6 Pieces, the Answer.

(20) s. d. oz. dwts. £. s. d.
Stated thus—If 5 10: 1 or 20::102 16 6
Or 25 70: 20 dwts: : 24678: 70505 dwts.

Or, as, 70: 20 dwts.:: 24678: 7050\(\frac{5}{2}\) dwts.

For by Reduction, 5s. 10d.=70d. and £.102 16s. 6d.=
24678d. which \times by 20, (the fecond Term=493560
dwts. thefe \(\div \) by 7, 0 (the first Term) gives 7050\(\frac{5}{2}\) dwts.
the Quantity of Silver bought, which, \(\div \) by 994 dwts.
(4lb. 10z. 14dwts.) the Weight of one Ingot, will give 7 Ingots, and 92 dwts. or 40z. 12\(\frac{5}{2}\)dwts. over the Answer.

(21) Stated thus—If 8\frac{1}{2}: 1:; 426 16

Or, as  $35:1::409728:11706\frac{18}{35}$  oz. For by Reduction  $8\frac{3}{4}d.=35$  qrs. and £. 426:16s.=409728 qrs. which  $\div$  by  $5\times7$  (35,) gives  $11706\frac{18}{35}$  oz. these  $\div$  by 16, 28, and 4, will give 6 Par. and 2 qrs. 3 lb.  $10\frac{1}{35}$  oz. over, the Answer.

(22) Here, first 100 Guineas=105£. lays by; then from £. 488 5s. his yearly Income, take 105£. remains, 383£. 5s. or 7665s. what he spends per Annum—then

D. s. D. s. Stated thus—As 365; 7665::1:21

for 7665 : 365 = 215. per Day.

(23) £. s. s. d. £. s. Stated thus—If 1 or 20: 3 9:: 564 12 Or, as 20: 45:: 11292: 25407d.

For by Reduction, 3s. 9d. =45d. and  $564\pounds$ . 12s.=11292s. which  $\times$  45d. (the fecond Term)=508140d. this.÷ by 20, (the first Term)=25407d. these, ÷ by 12 and K

하게 보고 있는 이 없는 경기를 하는 이 이 보고 있다. 하는 경기 때에서는 없는 그 하는 경우를 보면 보다 하는 것이 되는 것이 되는 때에 되었다. 이 집에 되었다.
20, will give £. 105 17s. 6d. Taxes, which, subtracted
Con Li I and Con Con I among the Contraction
from his Income, viz. £. 564 125. leaves £. 458 145.
gd. his neat Income. the Answer.
(24) s. d. oz. dut. f.
Cratal than 16 and a second
Stated thus—If 5 9:1 or 20:: 200
Or, as 23:20:: 16000: 13913 dwts.
For by Reduction, 3s. 9d.=23 Threepences, and 200f.=
for Diversity When the formation
16000 Ditto, which X by 20, (the fecond Term)=
320000 dwt. this : by 23 (the first Term) gives 13913 and dwts. these dwts. : by 692 (2lb. 1002. 12dwts.) the
droits, these droits - by 602 (2th, 1000, 12 droits) the
Beautification Tares Table State Land
Penny-weights in an Ingot, will give 20 Ingots, and
73 dwis. or 3 oz. 13 3 dwis. over the Answer.
(25) First 6×6×10×30=10800 Yards in the fix Packs, then
Yds. f. s. d. Yds.
Stated thus—As 3: 2 4 3:: 10800
Or. as 3: 531d. :: 10800: 1011600d.
For by Reduct. £.2 4s. 3d.=531 Pence, these × by 10800
101 by Reduct. 5.2 45: 30: -531 Tence, there > by 1000
=5734800d. which : by 3, (the first Term)=1911600
Pence. or 7965f. the whole cost him, and 3) 2f. 4
3d. (14s. 9d. coft per Yard
of the same control and the sa
(36) W. L. s. W.
Stated thus—If 16: 14 16:: 52
Or, as 16: 296s. :: 52: 962s.
By Reduction, £.14 16s.=296s. which ×52=15392s. theft
:by 16 (viz. 4×4) gives 962s. or £.48 2s. the Anf.
(27) £. 3.
Attached to the state of the st
Oxen, each, - 10 0
Cows, 1 2 Days of the contract
Calves, 1 10
그리고 하는 사람들은 그 사람들은 경우를 가장하는 것이 되었다. 그리고 하는 사람들은 사람들은 사람들은 사람들이 되었다.
Sheep, 0 19
One of each cost - £. 19 9
production of the contract of
near—and are regeliand X. though L. G. 13. 1808
T. 2. 01, 63. T. 2.
Stated thus—If 19 9:1: 116 14
20 20 20 20 20 20 20 20 20 20 20 20 20 2
389 )2334( 6 of each.
(28) £. £. s. d. £.
Stated thus—If 560: 374 10 61::1
Or, as 560: 359546 qrs. :: 1: $642\frac{25}{500}$ qr.
By Reduction £.374 10s. 63d.=359546 Farthings, which by 560 (viz.8 × 70) gives 642 3 grs. these reduced to
A Co ( Co
by 500 (viz.o × 70) gives 042 56 grs. there reduced in
Shillings, &c. will be 13s. $4\frac{1}{2}d_{\frac{2}{3}0}$ the Answer.

(31)

For 2

(30)

By 1

For 2

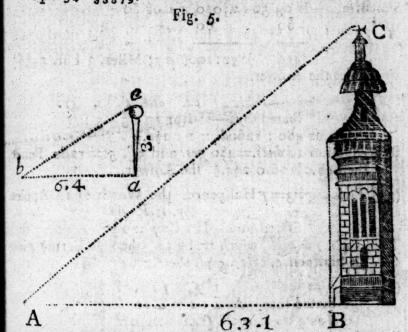
(29) First, the Cost, Custom, Fees, Freight, Factorage, and Profit, added into one Sum=f. 14 os. 2d.-then

C. qrs. lb. oz. £. s. d. C. lb.

Stated thus—If 18 3 17 7: 14 0 2:: 1 or 112

Or, as 33879: 3362d. :: 1792: 177310847 d.

By Reduction 18C. 3qrs. 17lb. 7oz.=33879oz. and 112lb. =17920z. Alfo 14£. 2d.=3362 Pence; then 3362d. ×179202. = 6024704 Pence, which ÷ 33879 (the first Term) gives 1774d. 10847, these d. by 12, give 14s. 93d. 33879, the Answer.



(30) Here the above Figures a c=3 Feet the Length of the Staff, a b=6 Feet 4 Inches, or 76 Inches, Distance or its Shadow. BC = the Height of the Tower, and AB=63 Yards, 1 Foot, or 2280 Inches Distance of its Shadow—then

> In. Ft. In. Ft.

Stated thus-As 76: 3:: 2280: 90 For 2280×3=6840 Feet, which - by 76=90 Feet, the Answer. For ac: ab :: BC : AB.

Stated thus-If 6 4: 285 :: i (31)Or, as 76: 285 :: 1: 3 M. 6 Fur. For 285:76=3 Miles 6 Fur. the Answer.

Pipe. G. £. s.
Stated thus—If 1 or 126:44 2:: 1 Pt.
Or, 25 1008: 10584d.:: 1 102d.

For 126 Gal.=1008 Pints and 44 £. 25. = 10584 Pence, which: by 1008 (the first Term) gives 102d. per Pint, the Answer.

(33) First 360×69½=25020 Miles the Circumference of the Globe—then

H. M. Miles. H. M.
Stated thus—If 23 56: 25020:: 1 or 60
60
60

1436 )1501200(1045 Miles, 3 Fur. 913436 Poles the Answer.

(34) oz. dwt. £. s. gr.
Stated thus—If 1 or 20: 5 5:: 1
Or, as 480: 1260d. :: 1: 25d.5

By Reduction 20 dwts.=480 grs. and 5£. 5s=1260 Pence, then 48,0)126,0(20d.10, the Answer.

(35) First 21:3=7 Halfpence, the Worth of 12 Apples, Ap. H.P. Ap.

Stated thus-If 12:7::14

Then 84×7=588, which ÷ by 12 (the first Term) gives
49 Halfpence, or 2e. c½d. the Answer.

(36) s. £. £. s.
Stated thus—As 4: 1:: 8 10
Or, as 4: 1:: 170; £.42 10s. od.

For 8f. 10s.=170s. which - by 4 gives 42f. 10s. the

(37) First 184×7×4+½(28½)=5244 Yards of the former, Stated thus—As 19: 14:: 5244: 3864

For 5244×14=73416, which: 19=3864 yds. the Answer. (38)

First 406×117=47502 Pieces: these × by 44d. (35. 8d. or the Value of one Piece will give 2090088 Pence, Value of all the Pieces—then

For a

(39)

By R

The

D

Her

d. Reas. d.
Stated thus—If 3: 20:: 2090088: 13933920
For 2090088 × 20 ÷ 3=13933920 Reas the Answer.

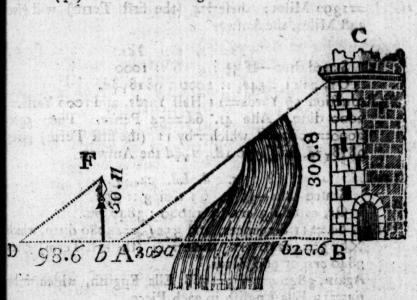
(39) First 274:5 £.54 16s. cost him; then
Ell E. qrs. s. d. Ell F.

Stated thus—If I or 5:7 10:: 274
Or, as 5:94d.:: 822: 15453\frac{1}{2}d.\frac{2}{3}.

By Reduction 7s. 101.=94 Pence, and 274×3=822 qrs. these × by 94=77268, which by 5, gives 15453 d. 3 or £. 64 7s. 9½d. 3 fold for.

Then from £.64 7s.  $9\frac{1}{2}d.\frac{2}{3}$  take £.54 16s. and there will remain £.9 11s.  $9\frac{1}{2}d.\frac{2}{3}$  gained, the Answer.

(40) 100) SAN 1 Fig. 6. All d. W. C. C. C.



Here F b=50 Feet, 11 Inches, or 611 Inches, Height of the May-Pole, and D b=98 Feet 6 Inches, or 1182 Inches, Length of its Shadow. Also B C=300 Feet 8 Inches, or 3608 Inches, and A B the Length of its Shadow—then

In. In. In. In.

Stated thus—As 611: 1182:: 3608: 6979

Then 6979: 12=581 7487=A. B.

And 30 F. 9 In. +20 F. 6 In. = 51 3 = Aa+B.

530 4487 = ab the

Breadth of the Stream required.

(41) M. s. M.
Stated thus—If 2: 15:: 7: 52s. 6d.
For 15×7=105s. which ÷by 2=52s. 6d. or £. 2 12s. 6d.

the Answer.

(42) H. M. D. H. Stated thus—If 4: 12:: 9:8 Or, as 4: 12:: 116: 348 Miles.

For 9 D. 8 H.—116 Hours, which × 12 (the second Term) = 1392 Miles; these -4 (the first Term) will give 348 Miles, the Answer.

(43) Yds. s. d. Yds. Stated thus—If  $5\frac{\pi}{2}$ : 4 6:: 1000 Or, as 11: 54d. :: 2000:  $9818\pi^{2}d$ .

By Reduction 5½ Yards=11 Half Yards, and 1000 Yards=
2000 ditto. Also 4s. 6d.=54 Pence. Then 54X
2000=108000d. which ÷ by 11 (the first Term) gives
9818<sub>7</sub>2d. or £. 40 18s, 2<sub>7</sub>2d the Answer.

s. d. Ell. qrs. L.
Stated thus—If 5 6: 1 or 3:: 352
Or, as 11: 3 qrs. :: 14080: 3840 qrs.

For 5s. 6d.=11 Sixpences, and 352f.=14080 ditto, which × by 3=42240 qrs. these÷11 (the first Term) give 3840 qrs. or 960 Yards.

Again, 3840 qrs.÷5=768 Ells English, which ÷ by 64=12 Ells English in each Piece.

(45) £. £. s. £. s. Stated thus—If 100: 4 15:: 40 10 Or, as 2000: 95s.:: 810: 38s.  $5\frac{1}{2}d.\frac{4}{5}$ 

For 100 f.=2000s. and f.4 15s.=95s. Also f.40 101. =810s. which  $\times$  by 95=76950s. these  $\div$  by 2,000 will give 38s.  $5\frac{1}{2}d$ .  $\frac{16}{20}$ , or f. 1 18s.  $5\frac{1}{2}d$ .  $\frac{4}{3}$  the Answer. He

(46

(47

Ву

(48

Ву

(49

Ву

(5

By

(5

Yds. Yd. Yds. Yds.

(46) First 24×20=480 Yards, contained in the 24 Pieces. Stated thus—As 12:8::480:320

Here 480×8=3840 Yards, which ÷ by 12, gives 320 yds. the Answer.

(47) A. L. s. d. A.
Stated thus—If 1: 1 19 6:: 240
Or, as 1: 79:: 240: 18960 Sixpences.

By Reduction £. 19s. 6d.=79 Sixpences, which × by 4 ×60 (240) the Product is 18960 Sixpences; these; by 40, will give 474£. per Annum; this ÷ by 4= £. 118 10s. per Quarter, the Answer.

(48) £. s. d. £.

Stated thus—If 1: 10 6: 1000

Or, as 1: 21:: 1000: 21000 Sixpences.

By Reduction 10s. 6d.=21 Sixpences, which × by 1000, the Product is 21000 Sixpences, these :40=525£. the Answer.

(49) M. fur. p. ft. Min, Mile. Yds. Stated thus—If  $37 2 37 5\frac{1}{2} : 4 :: 1 or 1760$ Or, as  $394592 : 4 :: 10560 : 6." 25\frac{146080}{394592}"$ 

By Reduction 37 m. 2 fur. 37 p.  $5\frac{1}{2}$  ft.=394592 Half-feet, and 1760 Yards=10560 ditto, which × by 4 Minutes (the fecond Term) the Product will be 42240 Minutes; this × by 60, to bring the Minutes into Seconds, gives 2534400 Seconds; these; by 394592 (the first Term) the Quotient is 6"  $25\frac{146080}{394592}$ " past 12, the Answer.

(50) £. s. d. E.E. £. s. d.

Stated thus—If 1 .7 10: 4:: 118 17 7½

Or, as 668: 80 nails:: 57063: 6033 668 nails.

By Reduction £. 1 7s. 10d.=668 Halfpence. And £. 118

17s. 7\frac{1}{2}d.=57063 ditto. Also 4 Ells English=80

Nails, then 57063 × 80=4565040 Nails, which ÷

by 663=6833\frac{566}{668} Nails bought; then to find how many Pieces, each 33 Ells Flemish, 1 qr. 2 na. or

402 Nails, are contained in the Quantity bought; thus, 402)6833(16 Pieces, and 33 Ells, 1 qr. 1 na. \frac{596}{668}

over, the Answer.

(51) First, from 100 f. take 60 f. Remains 40 f. Serge cost.

Yds. Y. Yds. Yds. Stated thus—As 2:3::236:354

Here 236×3=708; this by 2=254 Yards of Shalloon, which cost 60£. consequently 60£. by 354, will give 3s. 4½d.5½, what the Shalloon cost per Yard; and 40£. by 236, will give 3s. 4½d.½, what the Serge cost per Yard.

(52) Stated thus—If 14:8::4 19 17
Or, as 672:8::4757:56lb. 10.1353

By Reduction 14s.=672 Farthings, and f. 4 19s. 14d.=
4757 Ditto, which X by 8, (the fecond Term) the
Product will be 38056; this: by 672 (the first Term)
will give 56lb. 10 oz. 1 dr. 1184 the Answer.

(53) C. lb. s. C. qrs. lb.
Stated thus—If 1 or 112: 7:: 20 2 16
Or, as 112: 7:: 2312: 144s. 6d.

For 20 C. 2 grs. 16 lb. = 2312lb. these × 7s. = 16184s. which ÷ by 112 will give 144s. 6d. or £. 7 4s. 6d. the Answer.

(54) A Pipe=126 Gallons, from which take 12 Gallons, Remains 114 Gallons, or 456 Quarts, at 18d. per Qr. Then

Qt. d. Qts. d. Stated thus—As 1: 18:: 456: 8208

Here 456×18=8208 Pence, which : by 12 and 20, gives £.34 4s. fold for, from which take £. 25 4s. Remains 9£. gained, the Answer.

(55) C. qrs. lb. £. s. d. lb.
Stated thus—If 20 2 16: 7 4 9:: 1
Or, as 2312: 6948 qrs. :: 1: \(\frac{3}{4}\) qrs.

Here by Reduction 20 G. 2 grs. 16 lb.=2312lb. and £. 74.
9d.=6948 Farthings, which by 2312 (the first Term)
gives \(\frac{1}{2}\) \(\frac{2}{2}\), the Answer.

(56) First  $9 \times 4 = 36$  square Inches in one Brick, and  $20 \times 20$ = 400 Feet square, in the Floor, which  $\times$  by 144 = 57600 square Inches, the Content of Ditto.—Then Inch. B. Inch.

Stated thus—As 36: 1: 57600: 1600 For 57600: 6×6(36)=1600 Bricks the Answer, For 8

(57)

(58)

Here

(59) First

Bifc

Mea

For

(6c

TI An (57) First 22×4=88 Miles, I have gone before you set out, and 32-22=10-you gain upon me per Day; then Stated thus—As 10:1::88:84

For 88:10=84 Days, before you overtake me.

Then  $8\frac{4}{5} \times 4 \times 8(32) = 281\frac{3}{5}$  Miles, you travelled before I was overtaken, confequently  $350 - 381\frac{2}{5} = 68\frac{3}{5}$  Miles on this Side Edinburgh, the Answer.

(58) First, from 20 take 11. Remains 9 Days to be sunk. Days. Yea. Days.

Then stated thus-As 3: 400 :: 9: 1200

Here 400 × 9=3600; this - by 3=1200 Years after Anno 1700; then 1200 added to 1700=2900, the Year of Christ required.

(59) d. lb. d.

First, Beef cost per Day,  $2\frac{1}{4} \times 5 = 11\frac{1}{4}$ , and per Week,  $11\frac{1}{4}d$ .  $\times 7 = 6s$ .  $6\frac{1}{4}d = 315$  grs.

Biscuit cost per Day,  $1\frac{1}{2}d. \times 3lb. = 4\frac{1}{2}d.$  and per Week,  $4\frac{1}{2}d.$ 

 $\times 7 = 2s$ ,  $7 \pm d$ , = 1 26 qrs.

Meat for the Ship's Company cost per Day f.12 12s. and per Week f.12 12s.  $\times 7 = f.88$  4s, or 84672 Farthings. Stated thus—If  $315:126:84672:33868\frac{2}{3}\frac{5}{15}$  qrs. For  $84672 \times 126 = 10668672$ , which  $\div$  by  $315 = 3386\frac{2}{3}\frac{5}{15}$  qrs. or f.35 5s.  $7 - d.\frac{25}{3}\frac{5}{15}$ .

(60) H. M. H.

Stated thus-As 8: 135:: 1: 16m. 7 fur.

Here 135:8=16 Miles 7 Furlongs, what both rode per Hour.

M. fur. p. M. f. M. fur. p. Then, 16 7 oless 2 4=14 3 o

And, 14 3 0 by 2 = 7 1 20 B. rode per Hour.

Alfo, 7 1 20+ 2 4= 9 5 20 A. ditto.

For  $\begin{cases} 7 & 1 & 20 \\ 9 & 5 & 20 \end{cases}$  × by  $8 = \begin{cases} 57 & 4 & B \\ 77 & 4 & A \end{cases}$  travelled.

Proof, 135 Miles.

(61) Suppose 130 to be the whole Work; then A. will perform  $\frac{1}{13}$ th Part, and B.  $\frac{1}{10}$ th, which will be 13+to =23d. Part of the Work performed by them both together in one Day.

W. Day. W. D. H.M.

Then stated thus—As 23: 1:: 130: 5. 7.49\(\frac{13}{23}\)
For 130\(\div 23=5\) Days, 7 Hours, 49\(\frac{13}{23}\) Minutes, the Anfwer.

(62) Here, suppose 198 to be the whole Work, of which B. and C. will perform 1, viz. 11, and with the Help of A. they will perform 1, viz. the 18th Part in one Day, then 18—11=7th Part performed by A. alone.

Then stated thus-If 7:1::198

7)198(28 Days, 3 H. 25 M. the Anf.
To perform Questions of this Nature, you may suppose
any Number to be the Work, so that it will divide by the
different Times the different Persons perform the Work in;
thus, in the first Question I supposed 130, by Reason it will
divide by 13 and by 10, and nothing remains. Likewise
in the last Question I supposed 138, as it will divide by 18
and 11, and leave nothing remaining.

(63) Stated thus—A. 17: 3:: 140: 24 14 14 17 £. £. s. d.

Here 140×3=420; this  $\div$  by 17=24 14 1 $\frac{1}{4}$  1 $\frac{1}{17}$  taken off, Then from f. 140 take f.24 14s.  $1\frac{1}{4}$ d.  $\frac{1}{37}$ . Remains f.115 5s.  $10\frac{1}{4}$ d.  $\frac{6}{17}$ , the Affeffment, which  $\div$  by 5, gives f.23 1s. 2d.  $-\frac{8}{17}$  the Taxes; this, taken from f.140, leaves f.116 18s.  $9\frac{3}{4}$ d.  $\frac{9}{17}$ , the Answer.

(64) £.

First 1000 ÷ by  $\begin{cases} 5 = 200 \text{ gained by Land Trade.} \\ 8 = 125 \frac{\text{Sea ditto.}}{\text{Sea ditto.}} \end{cases}$ 

Sum, 325 Gain per Year.

For

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Then 1000 ÷ 2½=400 £. lost in 1 Year.

And 400 £.—395=75£. run out per Year.

£. 1. f.

Stated thus—As 75:1 :: 1000 : 193 For 1000:75=133 Years, the Answer.

(65) Here, from 10 in the Morning till 6 in the Evening is 8 Hours.—I fet out before you, then 2×8=16 Miles I travelled before you fet out, and 170—16=154 Miles. Also, 2+3=5 Miles both travelled per Hour.

M. H.- M.

Stated thus - As 5: 1: 154: 304

For  $154 \div 5 = 30\frac{4}{5}$  Hours they will meet. Then  $30\frac{4}{5} \times 2 = 61\frac{3}{5}$ , which added to  $16 = 77\frac{3}{5}$  Miles, or 77 m. 4 fur. 32 p. from Exeter; and  $30\frac{4}{5} \times 3 = 92\frac{2}{5}\text{M.}$  or 32 m. 3 fur. 8 p. from London.

Anliver 77 4 32 Distance from Exeter.

Proof, 170 Miles.

(66) First, from 13° take 1°, remains 12°, Moon gains of the Sun per Day.

And 30°+3=90, from the first of Aries to the first of

Also, 90°+3=93° Sun before the Moon. Then stated thus—As 12°: 1:: 93°: 72

For 93:12=7\frac{3}{4} Days, in which Time the Sun will be overtaken by the Moon.

... 7\frac{3}{4} + 3 = 10\frac{3}{4} Degrees of Cancer, the Answer.

(67) First, from 21 take 15. Remains 6 Rods, the Dogs gained in running 21 Rods, and fourscore=80+16=96 Rods the Hare started before the Dogs.—Then R. R. R.

Stated thus—As 6: 21:: 96: 336

Here 96×21=2016; this ÷ by 6, gives 336 Rods the Dogs
ran, and 336—96=240 Rods the Hare ran.

First, 52 Miles = 29920 Feet. Feet. Sec. Feet.

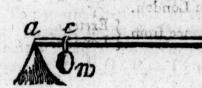
Stated thus-As-1150: 1: 29920: 261-1 For 2992,2-115,0 26 Sec. 123 Third, the Answer.

> (69) First, 1 Min. 3 Seconds=63 Seconds. Feet.

Stated thus-As 1 : 1150 :: 63 : 72450 For 1150×63=72450 Feet, or 13 Miles, 5 Furlongs, 30 Poles, 5 Yards, the Answer.

Fig. 7.

arded to be in Exeter; and got





(72

(73

(74

(75

(76

(77

(78)

So t

(1)

(70) Here a b=100 Inches, and a c=72, P. the Power, or 168lb. and w. the Weight to be moved.

Then from 100 take 7\frac{1}{2}, remains 92\frac{1}{2} = ab - ac = cb.

In. lb. In.

Stated thus If 7 : 168 :: 92 : 2972 Or as 15: 168:: 185: 2072.

Here 7 Inches=15 Half Inches, and 92=185 Half Inches, which × 168=31080 lb. thefe by 15=2072lb. =w. the Answer. For A's ac : P. :: cb : w.

rang and 836-96 each charge and

tirff, from at taken as licenses f

(71) First, 9×2=18 Inches the Diameter of the Crank.

Ft. In. Ft.

Stated thus-As 6: 18:: 9:27

For 18 x 9:6=162:6=27 Inches the Answer.

(72) Firft 621×3=1871b.Wt of 3 folid Feet of Water. Feet. lb. Feet. Therefore, Stated thus-As 6: 1874 :: 9: 2814 For 187×9:6=16871:6=2811b. the Answer.

Stated thus-As 25: 1000 :: 1: 40, fo the less is moved with a Force 40 Times greater than the other.

(74) Stated thus-As 60 : 8 :: 100 : 135 Anfw. as 13 1 to 1.

Stated thus-As 8: 48:: 1:6 (75)Answer, Lesser to the Greater as 1 to 6.

First 2 Hours × 60=120 Minutes. (76) Then-Stated thus-As 40: 120:: 1:3 Answer, the Swifter to the Slower, as I to 3.

(77) First 30×12=360, and 60 Inches=5 Feet. Then as 1:5:: 360: 1800 Consequently, 1800-5=1795 Feet, the Answer.

(78) First 50-5=10 Then-Stated thus-As 5: 10::1:2

So that the first Body hath been in Motion double the Time of the latter.

(13) THE RULE OF THREE INVERSE.

D. M. D.

(1) Stated thus—If 12: 48:: 72

48

copy mor volate dand was a copy many as small (9)576

Answer, 8 Men.

D. M. D.

IF72:8::12 Nation (350 ) of Second only

wirest root words, the

MA THE

12)576

Proof 48 Men. 1 - 20-20-11 199116 transfer Kaminda daritaya In.B. In.L.In. B.

Stated thus -- As 12 : 12 :: 4 : 36

Here 12 × 12=114; this -4=36 Inches long the Answer.

M. f.

Stated thus -As 500 : 6 :: 220 : 13m. 19-1

Here 500×6=3000, this + by 220, gives 13 Months, 1911 Days the Answer.

M. oz. M.

Stated thus-As 3: 14:: 8 5 oz. 5 dwts.

Here 3×14=42, this - by 8=5 oz. 5 dwts. the Answer.

s. d. oz. s. Stated thus—If 4 6:12::3

Or, as 9: 12:: 6: 18 oz.

Here 4s. 6d,=9 Sixpences, and 3s.=6do. then 12×9=108; this - by 6, the last Term, gives 18 oz. the Answer.

Qrs. Yds. Qrs. Stated thus-If 5: 275 :: 3

Here 275×5=1375, this - by 3, gives 458 yds. 1 gr. 11 ng. the Answer.

> (7) f. Yrs. f. Stated thus—As 80: 15:: 600: 2

Here 15×80=12,00, this by 6,00 gives 2 Years, the Answer.

M. W. D. M. (8)

Stated thus-If 10: 43 5:: 6

Or, as 10: 306:: 6:510

Here 43 w. 5d.=306 Days, which × by 10=3060, this? by 6, gives 510 Days, or 18 Months 6 Days, the Answer.

(9) First 3 grs .= 21 Feet. Then, Ft. Ft. F.

to the desired the

Or, as 96: 30::9:320

Here 24 ft.=96 grs. and 21=9 grs. then 96×30 (the fecond Term)=2880 Feet; these : by 9 (the last Term) gives 320 Feet=1062 Yards, the Answer.

Note. Paper is 27 Inches, or 21 Feet wide.

Mo. Men. Mo. (10)

Stated thus-As 3 : . 1500 :: 5 : 900 Here 1500×3=4500, this - by 5, gives 900 Men to continue in ; then from 1500 take 900, remains 600 Men to depart.

Here

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H.Cock. M. (11)

Stated thus -As 6 : 1 :: 15 : 24 Here 6 Hours × 60=360 Minutes, which - by 15, (the last Term) gives 24 Cocks, the Answer.

> Fig. 8. (12).

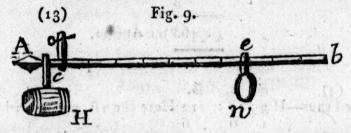


In the above Figure ab=100 Inches a c=71, Power, or 11 Cwt. and w. the Weight.

Then 100-72=922 Inches=ab -ac=cb.

Stated thus-As 921 : 11C. or 1681b. :: 71 Here 92=185 half Inches, and 7=15; then 185×168= 31080; this : by 15, (the last Term) gives 2072lb. or 18 Cthe Answer.

For as bc : w :: ac : P.



In the above Fig. ce = 70 Inches, Ac=2, H the Hogshead, and w the Weight.

In: C.

Stated thus—As 2: 9\frac{1}{2} :: 70

Or, as 2: 1064lb.:: 70: 30lb. 6 ez. 628drs. Here 92C.=1064lb. which x by 2=2128lb. these by 70, (the last Term) gives 30lb. 60z. 628 drs. the Weight required.

For as Ac: w :: ec: H.

(14) Stated thus - As 100000: 20:: 30:66666 Feet 8 Inches per Second, the Answer.

Feet. lb. (15)16.

Stated thus-As 200: 100:: 8: 2500 Feet per Second.

(14) CONTRACTIONS in the RULE of THREE.

Yds. f. s. d. Yds.

(1) Stated thus—If 4: 3 17 6:: 28 Here the first

× 7 7 and Second [Term by 4.

Answer, £. 27 2 6

(2) First 3×3=9 C. in the three Chests.

Stated thus—If 9C.: 11£. 13s. :: 72 Here the first and 3d.

8 8 First 3×3=9 C. in the three Chests.

Anfwer, £. 93 4 0

(3) C. L. C.
Stated thus—If 26: 78:: 156 Here 1st and 2d. + by 26.

1 3 8

L. 468 the Answer.

(4) 16. s. 16.

Stated thus—If 3: 18:: 112 Here the 1st. and 2d. ÷by 3.

1 6 6

Answer, £.33 125. od.

(5) First 6×8=48 Yards in the 6 Gowns. Yds. f. Yds.

Then—Stated thus—If 48: 6:: 64 Here the 1st. and 2d.:
8)64(8f. the Answer. [by 6.

(6) First, 11C.=1681b.

1b. s. lb. [12.]
Then—Stated thus—If 24: 12:: 168 Here 1st. and 2d. ÷
2)168(84s. or 4€. 4s. Answer.

(7)

(8)

The

(9)

(10) S

(1)

Now And Ther By t

(2) P

By t

(7) First 24×3=72 Yards in the 3 Pieces.

Yds. £. s. Yds.

Then—If 72: 64 14:: 8 Here 1st. and 3d. ÷by 8.

9)64 14(7£. 3s. 9\frac{1}{3} Answer.

(8) First  $6 \times 3 = 18lb$ . in the 6 Parcels.

1b. £. s. lb.

Then—If 18: 12 19::6 Here 1st. and 3d. Terms: by 6.

3)12 19(£. 4 6s. 4d. the Answer.

In. In. In. [by 3. (9) Stated thus—If 12:12::3 Here the 1st. and 3d. :

Answer, 48 Inches, or 4 Feet.

(10) M. C. M. [by 64. Stated thus—If 512: 225:: 64 Here 1st. and 3d. :

Answer, 1800 Cut.

(15) The RULE of FIVE:
Or, The DOUBLE RULE of THREE.

P. D. A.

(1) Placed thus, 6: 12: 72

**—** 4 120

Now, per Rule 5th, 72×4=288 Divifor.

And, 12×6×120=8640 Dividend.

Then, 8640 - 288 = 30 Men, Answer. By two Statings, First, As 12:6::4:18

Second, As 72:18:: 120: 30 Men, as before.

(2) P. D. B.

Placed thus—6: 12: 2, Then  $6 \times 12 = 72$ , the Divisor. 36: 4:—, And  $36 \times 4 \times 2 = 288$  the DiviSo  $288 \div$  by 72 = 4 Bushels, Answer. [dend.

By two Statings, First, As 6: 2:: 36: 12Second, As 12: 12:: 4: 4 Bu.

(8)

M.

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(3) P. W. L. Now 21×6=126 the Divisor.
6:21:120, And 46×14×120=77280f. Divid.
14 46—. Then 77280:126=£.613 6s. 8d. the
Answer.

By two statings, First, As, 6:120::14:280 Second, As, 21:280::46:£.613 6s. 8d.

(4) Here £.9 5s.=8880 Farthings, and £.70 10s. 33d.=

C. C. qrs. Then 8880×125=1110000 the Divisor, 40:100:8880 And 67695×40×100=270780000 Div. -:12567695 So 27078,0000:111,0000=243C. 3 qrs. 21lb. 1502. 2, 18 drs.

By two Statings, First, A.'s 100: 40::125:32. Second, As 8880: 32::67995:243C. 3qrs. 21lb. 150. 2718drs.

(5) First, from £.125 8s. take 120£. Remains 5£.8s. or 108s. Interest.

£. M. s. Then 120×9=1080 the Divisor.

120:9:108 And 108×12×100=129600s. Dividend

100 12:—. Therefore 12960,0:108,0=120s. or 6f.
the Answer.

By two Statings, First, 9: 109:: 12: 1445. Second, As 120: 144:: 100: 120.=6£.

(6) First, 100 f. = 24000 Pence, and f.259 135. 5d.= 62321do. then

D. W. L. Here  $52 \times 24000 = 1248000$  the Divisor. 24000: 52:5 And  $62321 \times 5 \times 20 = 6232100$  Dividend. 62321:20:- Therefore  $62321,00 \div 12480.00 = 1.4191.$  $10\frac{1}{4}d.\frac{105}{10443}$  the Answer.

W. W. £. s. d. By two Statings. First, As,  $52:5:20:1:18:5\frac{1}{2}\frac{2}{13}$ . Second, As, 240001.  $38s.5\frac{1}{2}d.\frac{2}{13}$ ; : 621321. £.4 19s.  $10\frac{1}{4}d.\frac{1}{13}$ , as before.

By two Statings, First, As, 5: 1400:: 8:875. Second, As, 14:875:: 8:500 Men.

(8) First, 10 Guineas=210 Shillings, and 5£.=100s. then M. D. s. Here 100×12=1200 the Divisor.

8:5:: 100 And 210×8×5=8400 the Dividend.

-: 12: 210 Therefore 84.00÷12.00=7 Men, the Ans.

By two Statings, First, As, 5:8: 12: 3\frac{1}{3}.

Second, As, 100: 3\frac{1}{3}:: 210: 7 M:n.

(9) First, 24 Weeks, 4 Days=172 Days; then

M. D. f. Here  $140 \times 12 = 168c$  the Divisor. 5:172:140 And  $172 \times 5 \times 5200 = 172000$  the Dividend. 12:--:200 Therefore  $17200,0 \div 168,0 = 102\frac{54}{168}$  Days, or 3 Mo. 2 W.  $4\frac{64}{168}$ D. the Answer. By two Statings, First, As,  $5:172::12:71\frac{2}{3}$ . Second, As,  $140:71\frac{2}{3}::200:102\frac{2}{7}$  D. or 3 Mo. 2 W.  $4\frac{2}{7}$  D.

- (10) First, 3£. 10s.=70s. and 38£. 10s.=770s. Also r Year=44rs. and 1½=5 qrs. £. qrs. s. Here 70×5=350 the Divisor. 100: 4: 70 And 770×4×100=308000 the Dividend. -: 5: 777 Therefore 30800,0:35,0=880£. Answer. By two Statings, First, As, £.4: 100£. 5: 87s. 6d. 1050d. Second, As 70: 1050£.:: 770: 211200d.=880£.
- (11) First, 36s. by 12 (the Sacks in a Chaldron) = 3s. what the Coals cost per Week, and 41£. 820s. then P. w. s. Here 3×6=18 the Divisor.
  7: 1: 3 And 820×7=5740 the Dividend.
  -: 6: 820 Therefore 5740 : 18=318 Poor, the Answer.
  By two Statings, As, 1: 7:: 6: 1½.
  Second, As, 3: 1½:: 820: 318 Poor.
- (12) First, As, 2: 11:: 3: 16\frac{1}{2} A. goes, while B. goes

  17.

  Then 17—16\frac{1}{2}=\frac{1}{2} Toise B. gains of A. in going 17 Toises.

  Again.

As  $\frac{1}{2}$ : 17::  $\frac{1}{2}$ : 17 Times round gone by A. and 16 $\frac{1}{6}$  by B. the Answer.

to the first state of the first

(13) First 18×2=36 Inches, Length of the Leaver; then In. Ft. In. Ft.

Stated thus—As 40: 104:: 36: 933. Feet. Hou. Feet.

Again,—As  $93\frac{3}{5}$ : 1:: 73: 10 Hours, 8 Min. 20 Sec. the Answer.

In. ll. In. lb.

(14) Stated thus—As  $1: 1\frac{1}{2}:: 12: 18$ wt. 12 In. } from the Again, As  $1: 1\frac{1}{2}:: 28: 42$ wt. 28 — } Shoulders. Confequently 42-18=24lb. the Answer.

(15) First, 30 Inches=2½ Feet, 24=2 ditto, and 4C. 70lb. =518lb. then 11-2½=8½ Feet; also 11-2=9. Feet. lb. Feet. lb. [former Case.

Stated thus—As 11: 518::  $8\frac{1}{2}$ :  $400\frac{3}{1}$  Force in the And Contra, As  $8\frac{1}{2}$ :  $400\frac{3}{1}$ ::  $2\frac{1}{2}$ :  $117\frac{3}{1}$  Preffure.

Again, As 11: 518::  $9:423\frac{3}{1}$  Force in lat. Ca Also, As  $9:425\frac{3}{1}$ ::  $2:94\frac{2}{1}$  Preffure.

H. D. H. D.

(16) Stated thus—As 12: 7:: 16: 5\frac{1}{4} of 16 Hours each.

M. D. M. D. H. M.

Then, As 152: 5\frac{1}{4}:: 576: 19 14 18\frac{114}{152}, the Answer.

M. Gall. M. Gall.

(17) Stated thus—As 9: 14:: 31:  $48\frac{2}{9}$  fills in 31 Minutes. Then  $48\frac{2}{9}$ — $40=8\frac{2}{9}$  Gallons in the Tub at the End of 31 Minutes.

And from 2 to 5=3 Hours, or 180 Minutes.

M. gal. M. gal.

Again, As 31:  $8\frac{2}{9}$ :: 180:  $47\frac{23}{31}$  fills in 3 Hours. And  $147-47\frac{23}{31}=99\frac{8}{31}$  Gallons wants of being full.

gal. M. gal. M. sec.

Also, As 14: 9:: 9938: 63 48 1428, the Tub will be full.

Which added to 5 o'Clock, will give 3 Min. 48 1428 Sc. after 6, the Tub will be full.

(18) First 1½d.=3 Halfpence, and 6s. 7½d.=159, Ditto.

Stated thus—As 3: 1:: 159:  $53=\frac{4}{5}$  of the Rent. Then  $53\pounds \cdot \div 4=13\pounds \cdot 5s \cdot =\frac{7}{5}$  of the Rent, the Answer. For  $53\pounds$  added to  $13\pounds \cdot 5s$  gives  $66\pounds \cdot 5s$  the whole Rent.

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L. s. L. s. s. L. s.

Again, As 1: 4:: 66 5, 265 or 13 5 the Answer.

Or, instead of the last Stating, thus; from £.66 5s. the whole Rent, take 4, viz. 53 L. Remains f.13 5s. the King's Tax, as before.

(19) First, 45+13=58 Perfons, and 17 Gaineas=375

Shillings.

P. f. P. Stated thus—As 45: 20:: 58: 25% f. in the same Time.— And in twice that Time the 38 Persons will spend 25% X2=51 f.'s Worth at 17 Guineas per Head.

Then-As 513: 17 or 357: 63: 436 24, 416 = 6.11 16s. 21d. 2716 per Hhd. which × by 2-1. 23 125. 51d.

per Pipe, the Answer.

(10) First 8-5=3 Miles B. | gained of A. in one Day.

And 10-5=5 M. D. M. D.

Then Stated thus-As 3 : 1 :: 73 : 243 when A and B meet.

So that B nor C can never meet with A but at the End of these Periods, when A and C will have travelled 219 Miles.

> D. D. D. M. .. Then, As 143: 219 :: 241: 1365. D. M.

 ${19 \atop 465}$  × by  ${24 \atop 143 \atop 3}$  = 5329 Days, the 73d Time of their general Meeting .. 5329-73=73 Days, their first general Meeting.

M.

For As 73:  $\begin{vmatrix} 24\frac{1}{3} \\ 14\frac{3}{3} \end{vmatrix}$  : :  $\begin{vmatrix} 219 \\ 365 \end{vmatrix}$ : 3 Days.

(21) First, for every Day he worked he received 12 Pence. And for every Day he played he paid

Sum, 20

Likewise, as his idle Days came to the same Money as those he worked, therefore the Proportion will be as follows: D. D. D.

20:390 8:156 Days he worked.

And As, 20: 390 12: 234 - played. For 156, at 12d. per Day, comes to the fame Money \$ 234 at 8d. per Day, viz. £. 7 17s. the Proof.

(22) First, sourscore and eleven, or 91 Guineas=5733 Four-pences.

And from December 11, to May 20th=150 Days.

Alfo, 100 Marks=4000 Four-pences.

or red of A. in the contract

And from September 3d. to Christmas=113 Days.

Then Stated thus—As 5733:150::4000:214355, or 12. ther 215 Days, from which take 113=102 Days, and £. 40=2400 Four-pences.

Again Recep. As 4000: 102:: 2400: 170 Days, the Anfwer nearly.

(23) First £. 2 15. 8d.=500 Pence, and 500 = 25 Days
Wages; then 40-25=15 Days more.

For every day he worked he had — 20 Pence.

And for every Day he played, — 10

Sum ga

d. D. d. D.
Then—As 80: 15:: { 10: 5 worked. 20; 10 idle.

.. He was idle to Days and worked (5+25)=30 Days.

## (16) PRACTICE.

(1) 
$$\frac{1}{4} \begin{bmatrix} \frac{1}{4} & 2107 & 2t & \frac{1}{4}d \\ 12 & 526\frac{3}{4} \\ 2,0 & 4.3 & 10 \\ \hline £.2 & 3 & 10\frac{3}{4} \end{bmatrix}$$

(6)

(8)

d. 
$$\frac{1}{2}$$
  $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{638}$   $\frac{3}{319}$   $\frac{1}{957}$   $\frac{9}{2.0}$   $\frac{9}{2.0}$   $\frac{1}{2}$   $\frac{9}{2.0}$   $\frac{9}{2.0}$   $\frac{1}{2}$   $\frac{9}{2.0}$   $\frac{1}{2}$   $\frac{9}{2.0}$   $\frac{1}{2}$   $\frac{1}{2}$   $\frac{9}{2}$ 

100g6-12 (14)

(7)

(6) 
$$1\frac{1}{2}$$
  $\frac{1}{8}$  2462 at  $1\frac{1}{2}d$ . 2.0  $\frac{30.7}{\text{$f$}}$  9

TI	1 8 E	1041 at 13d.
4	<u>6</u>	130 I 21 84
	2,0	15,1 91
)		£.7 11 93

Practice.

(17

(19)

(21)

(23)

(9) 
$$\frac{d}{6}$$
  $\frac{1}{6}$   $\frac{2408}{6}$  at  $2\frac{1}{4}$  (10)  $\frac{d}{6}$   $\frac{1}{6}$   $\frac{640}{6}$  at  $2\frac{1}{2}d$ .

(11) 2 
$$\frac{1}{6}$$
 1740 at  $2\frac{1}{4}d$ . (12) 3  $\frac{1}{4}$  746 at  $3d$ .  $\frac{1}{2}$  290  $\frac{$ 

(13) 
$$\frac{1}{4}$$
  $\frac{1}{4}$   $\frac{1}{7}$  at  $\frac{1}{3}$  (14)  $\frac{1}{4}$   $\frac{3091}{6}$  at  $\frac{1}{3}$   $\frac{1}{4}$   $\frac{1}{6}$   $\frac{1}{2}$   $\frac{1}{2}$ 

(15) 
$$\frac{1}{3}$$
  $\frac{1}{4}$  214 at  $3\frac{3}{4}$  (16) 4  $\frac{1}{3}$  2000 at 4d.  $\frac{3}{4}$   $\frac{3}{4}$   $\frac{53}{13}$   $\frac{6}{13}$   $\frac{4}{12}$   $\frac{1}{4}$  2,0  $\frac{6}{13}$   $\frac{6}$   $\frac{6}{13}$   $\frac{6}{13}$   $\frac{6}{13}$   $\frac{6}{13}$   $\frac{6}{13}$   $\frac{6}{$ 

(17) 3 
$$\frac{1}{4}$$
 569 at  $4\frac{1}{4}d$ . (18) 3  $\frac{1}{4}$  1246 at  $4\frac{1}{2}d$ .  $\frac{1}{3}$  142 3  $\frac{1}{4}$  47 5 11  $10\frac{1}{4}$  20,1  $6\frac{1}{4}$  20,1  $6\frac{1}{4}$   $\frac{20,1}{4}$   $\frac{61}{4}$   $\frac{1}{4}$   $\frac{1}{4}$ 

(19) 3 
$$\frac{1}{4}$$
  $\frac{1426 \text{ at } 4\frac{3}{4}d}{356 6}$  (20) 4  $\frac{3}{4}$   $\frac{2740 \text{ at } 5d}{913 4}$   $\frac{1}{4}$   $\frac{3}{4}$   $\frac{1}{4}$   $\frac{3}{4}$   $\frac{1}{4}$   $\frac{3}{4}$   $\frac{1}{4}$   $\frac{913}{228 4}$   $\frac{4}{228 4}$   $\frac{2}{4}$   $\frac{1}{4}$   $\frac{1}{4}$ 

(21) 4 
$$\frac{1}{3}$$
 2147 at  $5\frac{1}{4}$ 6. (22) 4  $\frac{1}{3}$  674 at  $5\frac{1}{4}$ 6.  $\frac{1}{4}$  715 8  $\frac{1}{4}$  178 11  $\frac{1}{4}$  834  $\frac{1}{4}$  2,0  $\frac{1}{93.9}$   $\frac{3}{4}$   $\frac{1}{4}$  6 19  $\frac{3}{4}$   $\frac{1}{4}$  6 19  $\frac{3}{4}$   $\frac{1}{4}$  6 19  $\frac{3}{4}$   $\frac{1}{4}$  6 19  $\frac{3}{4}$   $\frac{1}{4}$   $\frac{1}{$ 

(23) 3 
$$\frac{1}{4}$$
 1746 at  $5\frac{3}{4}d$ . (24) 6  $\frac{1}{4}$  1741 at 6d. 87,0 6  $\frac{1}{4}$  109  $1\frac{1}{2} = \frac{1}{4}$  of 3d. 2,0  $\frac{83,6}{4}$  16  $7\frac{1}{2}$ 

M

Practice.

(33) d

(35)

(37)

(39)

d. (25) 
$$\frac{4}{4}$$
  $\frac{1}{3}$  2142 at  $6\frac{1}{4}d$ . (26)  $\frac{1}{2}$  1040 at  $6\frac{1}{2}d$ .  $\frac{1}{4}$   $\frac{1}{2}$   $\frac{1}{4}$   $\frac{1}{2}$   $\frac{1}{3}$  357  $\frac{1}{4}$   $\frac{1}{2}$   $\frac{1}{$ 

(31) 4 
$$\frac{1}{3}$$
 674 at  $7\frac{3}{4}d$ . (32) 6  $\frac{1}{2}$  2170 at 8d.  $\frac{1}{3}$  168 6  $\frac{1}{4}$  42  $1\frac{1}{2}$   $\frac{1}{4}$  of 3  $\frac{1}{4}$  42  $1\frac{1}{2}$   $\frac{1}{4}$  of 3  $\frac{1}{4}$  4.5  $3\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$  15  $3\frac{1}{2}$ 

	1				j	
(33)	6	<u>1</u>	1700 at 811.	(34)	d. 6	1765 at 8½d.
	2	3 1	850 283 4		2	88 <sub>2</sub> 6 4 294 2
	4	8	35 5			73 61/2
		2,0	116,8 9		2,0	125,0 21
		89	£.58 8 9	*	+	£.62 10 2½
35)	6	1 2	740 at 83d.	(36)	6 1	1417 at 9d.
	2		374 6		3 1	
13	3/4	1 8	124 10 $46   9\frac{3}{4} = \frac{1}{8}   01$	6d.		354 3
		and the second	54,6		2,0	106,2 9
		Ex-24				£.53 2 9
		•	£.27 6 13/4		\$ -40 	
(37)	6	12	2373 at 9\d.	(38)	6	1476 at 91d.
	3	12	1186 6			738
	4	72	593 3 49 54		2 1 <sup>1</sup> / <sub>2</sub>	246 [6d. 14 184 6=1 of
	1	2,0	182,9 23			0 116,8 6
			£.91 9 2 4		1	£.58 8 6
(39)	6	1 2	1760 at 9\frac{3}{4}d.	(40)	6 1	6000 at 10d.
	3 34	1 1 4	880			3000
	34	4	440 110		4 3	2000
		2.0			2,0	500,0
		2,0	143,0			£.250
			£.71 10			

M 2

4		4 Tucilce.
(41)	d. 6	$ 4652 \text{ at } 10\frac{1}{4} $ (42) 6 $ \frac{1}{2} ^2476 \text{ at } 10\frac{1}{2} $
	3 1 4	96 11
		2,0 397,3 7 £.198 13 7
(43)	6	1 2176 at 103d (44) 6 1 1276 at 11d.
	434	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
		2,0 194,9 4 £.97 9 4  2,0 116,9 8  £.58 9 8
(45)	6	$\frac{1}{2}$ 2142 at 11 $\frac{1}{4}d$ . (46) 6 $\frac{1}{2}$ 4760 at 11 $\frac{1}{2}d$ .
	4 1 4	2.0 456.1 8
		$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
		(47) 6   ½640 at 113d.
		3 320
		$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

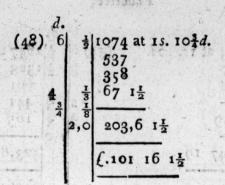
2,0 62,6 8

£.31 6 8

(51)

of the

(49)



When the Price is 2, 3, 4, 6, or 8d. you may make Use of this Method.—Thus; for 2d. divide the given Quantity by 120; for 3d. by 80; for 4d. by 60; for 6d. by 40; and for 8d. by 30, which will give the Answering Pounds, &c.

(51) 4 
$$\frac{1}{3}$$
 2140 at 1s. 5d. (52) 6  $\frac{1}{2}$  1453 at 1s.  $7\frac{1}{2}$ d. 713 4  $\frac{1}{4}$  178 4 2,0 303,1 8  $\frac{1}{2}$  2,0 236,1  $\frac{1}{2}$  £.118 1  $\frac{1}{2}$ 

straig land the control division to to the and a will give the

ALIMEY AS above.

, stopped of them else may be performed to as he had not a bot a found; therefore

(64)

(67)

2,0

£.

(

(72)

(74)

(76

(53) 6 1 1614 at 15. 10d. 4 1 538	(54) 6 1 3 1	2647 at 15. 114d. 1323 6 661 9 441 2= \frac{1}{3} \text{ of 6d.} 165 5\frac{1}{4}
	3	165 5±
£.147 19	2,	528,8 104
		£.261 18 104

The 53d Example may be performed thus—1s. 8d. is  $\frac{1}{12}$  of a Pound, 2d. is  $\frac{1}{10}$  of 1s. 8d.

(55)	2476 at 25		(56)	1476	at 4s.	
	£. 247 12	ů.	1.5.	£. 295 4	ι,	(0.1
(57)	276 at 6s.	,		2100	at 8s.	
	£. 82 16			£. 840	, 0	
(59)	274 at 105		(60)	674 6	at 125.	
£	. 137,0	0 (22		£. 404	<b>8</b>	(1)
(61)	2680 at 145.	(62)	267 at 16	ş. (63)	1267	at 18s.
£. 1	876 0	£.	213 12	2	. 1140	6

The 55, 56, and 59 Examples may be performed thus: 2s. is  $\frac{1}{10}$ , 4s. is  $\frac{1}{5}$ , and 10s is  $\frac{1}{2}$  of a Pound, therefore the given Quantities being divided by 10, 5, and 2 will give the Answer, as above.

(64) 2174 at 75. (65) 1427 at 95. (66) 647 at 115. 7

2,0)1521,8
2,0)1284,3
2,0)711,7
£.760 18
£.642 3
£.355 17

(67) 267 at 135. (68) 274 at 175. (69) 1260 at 195. 19
2,0)357,1
2,0)465,8
2,0)2394,0
£.173 11
£.232 18
£.1197 0

(70) 
$$45.\frac{1}{3}$$
)2420 at 45. (71)  $55.\frac{1}{4}$ )1764 at 55. £.484
£.396 16 8
£.396 16 8
£.396 16 8
£.58 7 6

(74) 35.  $4d.\frac{1}{4}$ )1760 at 35. 4d. (75) 65.  $8d.\frac{1}{3}$ )176 at 65. 8d. £.293 6 8

£.293 6 8
£.58 13 4

(76) 3  $\frac{1}{4}$ 1420 at 35. 3d. (77) 6  $\frac{1}{2}$ 427 at 55. 9d.  $\frac{1}{3}$ 5.  $\frac{1}{4}$ 660  $\frac{1}{3}$ 55  $\frac{1}{4}$ 661,5  $\frac{1}{4}$ 669  $\frac{1}{4}$ 69  $\frac{1}{4}$ 69  $\frac{1}{4}$ 69  $\frac{1}{4}$ 79  $\frac{1}{4}$ 79  $\frac{1}{4}$ 79  $\frac{1}{4}$ 79  $\frac{1}{4}$ 79  $\frac{1}{4}$ 79

(84)

(86)

(88)

(90)

d		d
	10s. 8\d. (7	9) 6 ½ 174 at 175. 9½d.
2 13 4020 201 67 3 4 8 25 1½	= <u>t</u> of 6.	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
£.215 1	-	2,0309,5 9 £.154 15 9
(80)	*	(81)
3 273 at 19s.	$4\frac{3}{4}d$ . 6	2 260 at 14s. 11d.3
5 t 8 7 68 3 22 9	3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	of 3d. 2	1 Park A
£.264 15 C	) <del>1</del>	2,0389,4 7 £.194 i4 7

Example 76 may be performed thus—2s. is  $\frac{1}{10}$ , is is  $\frac{1}{2}$  of 2s. and 3d. is  $\frac{1}{4}$  of 1s.—Example 77, thus; 5s. is  $\frac{1}{4}$ , 6d. is  $\frac{1}{10}$  of 5s. and 3d. is  $\frac{1}{2}$  of 6d. Likewife Example 78, thus; 10s. is  $\frac{1}{2}$  of a Pound, 6d. is  $\frac{1}{20}$  of 10s. 2d. is  $\frac{1}{3}$  of 6d. and  $\frac{3}{4}$  is  $\frac{1}{8}$  of 6d. which Parts added together will give the Answers, as before.

(82)	120 at 4£.	(83)	96 at 17£.
Ĝ	(.480	C.	1632

100 at 3£. (85) 142 at 42£. 
$$6 \times 7 = 42$$

1. 300

1. 5964

(88) 142 at 1£. 175. (89) 15. 
$$\frac{1}{20}$$
 164 at 24£. 195.  $5 \times 5 = 25$ 

2,0)241,4

120 14 added to 142£.

£.4091 16

(90) 271 at 
$$5\mathcal{L}$$
. 75. (91)  $5$ 

$$\frac{5}{1355\mathcal{L}}$$
2,0)189,7=271×7
$$\frac{91}{17} \text{ added to } 1355\mathcal{L}$$

$$\frac{1}{2}$$

and supplied

105

6

(10

(10

1

(92) 105. 
$$\frac{1}{2}$$
 914 at 10 £. 155. (93) 737 at 1£. 145.  $\frac{7}{515}$  18 added to 737£.  $\frac{1}{2}$  457  $\frac{1}{228}$  10 £. 1252 18

6s. 8d. 
$$\begin{vmatrix} \frac{1}{3} \end{vmatrix}$$
 274 at 7£. 6s. 8d. 3s. 4d.  $\begin{vmatrix} \frac{1}{6} \end{vmatrix}$  120 at 12£. 3s. 4d.  $\begin{vmatrix} \frac{1}{6} \end{vmatrix}$  120 at 12 $\begin{vmatrix} \frac{1}{6} \end{vmatrix}$  120 at 12 $\begin{vmatrix} \frac{1}{6} \end{vmatrix}$  120 at 12 $\begin{vmatrix} \frac{1}{6} \end{vmatrix}$  120 at 12

1s. 8d. 
$$\begin{bmatrix} \frac{1}{12} & 97 & \text{at } 9£. \text{ is. } 8d. & 55 & 4 \end{bmatrix}$$

$$\begin{bmatrix} \frac{1}{12} & 97 & \text{at } 9£. \text{ is. } 8d. & 55 & 4 \end{bmatrix}$$

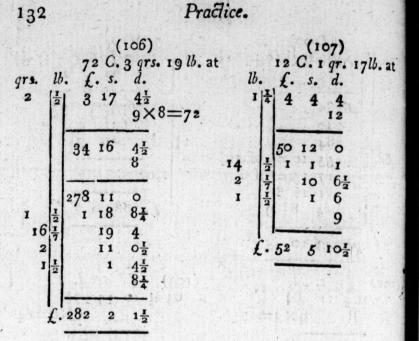
$$\begin{bmatrix} \frac{1}{12} & 21 & 21 & 42£. & 55. \\ 7 \times 6 = 42 & 7 \times 6 = 42 & 128$$

279 at £.61 15.9d3.
1674 0 139 10 13 19 1 6 19 6 1 3 9 9 0 17 5 4

£.1838 15 84

105. 1420 at £.1914113	4d. $\frac{1}{3}$ 2074 at $f$ . 17 $5\frac{1}{2}$ 37 20
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	76738 37 691 4 259 3 2,0 7768,8 7 £. 3884 8 7
(102) $f$ . s. d. 27 at 4 11 $8\frac{3}{4}$ $9\times 3=27$	(103) £. s. d. 64 at 12 13 7\frac{1}{8} \times 8=64
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	101 8 10 8 £.811 10 8
(104) $f$ . s. $d$ . (105) $\frac{1}{2}$ 17 6 7	dwts. $f.$ s. $d.$ 10 $d.\frac{11}{2}$ 3 16 10 $\frac{1}{2}$ 6
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	23 I 3 7 161 8 9
£. 6 18 5\frac{18}{4}	1614 7 6 1 18 5 4 1 1 5 4 2 1 4 3 10
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

## Practice.



۱	4	. s.	$\frac{d}{1\frac{1}{2}}$	
			11×	
	51	15	4 1/2	
7	103	10	9	
	4	14	1 ½ 5 ¼	
8		13	5 <sup>1</sup> / <sub>4</sub>	3747

12) lb.

(109)	d.						ſ.	s.	d.
. 5		4	476	A. 3	r. 28	p. at			
			3			, kur			
			1428						
			119						
2	6	2	59	10					
	5	6	9	18	4				
2	r.	1 2	1	13	112	$=\frac{1}{2} \cdot 0$	13	7	11
1	p.	1 2		16	113				
	20			8	$5\frac{3}{4}$				- 14
		5		3	434				
		£	1619	11	134				

(110) 16C. 29rs. at £. s. d.	(111) 48C. 2grs. 7lb. at £. s. d. 2 grs. ½ 74 16 6
9 7 8	8×6=48
4×4=16	598 12 0
37 10 8	716. 18 37 8 3
1 3 5½	4 13 614
. 38 14 1½	£.3633 13 9¥

12) 24lb. at f. s. 16 
$$\frac{1}{7}$$
 4 17 per C.  $\frac{16}{7}$  0 13 10 $\frac{1}{4}$  0 6 11 £. 1 0  $\frac{1}{4}$ 

(113)

lb. £. s. d.

14 
$$\frac{1}{8}$$
 3 5 4

2  $\frac{1}{7}$  0 8 2

1  $\frac{1}{2}$  0 1 2
0 0 7

£. 0 9 11

When the Pupil is perfect in all the preceding Cases, he may then learn the Contractions, some of which are as follow:

CONTRACTIONS to CASE I. and II.

CONTRACTIONS to CASE I. and II.

d.

3 | 
$$\frac{1}{80}$$
 |  $1276$  at  $\frac{3}{4}$  |  $3$  |  $\frac{1}{30}$  |  $174.0$  at  $2\frac{3}{4}d$ .

1 |  $\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{5}$  |  $19$  |  $\frac{1}{4}$  |  $\frac{1}{72}$  |  $\frac{21}{72}$  |  $15$  |  $0$  |  $1$  |  $16$  |  $3$  | fubtrade  $f$  |  $f$ 

is.

£.

(3

(3) See Example 3.

s. d.

2 6 
$$\frac{1}{8}$$
 1420 at  $7^{\frac{1}{2}}$ 
 $7^{\frac{1}{2}}$   $\frac{1}{4}$  177 10

£. 44 7 6

See Example 30.

CONTRACTIONS to CASE III. VII. and IX.

(5) 3d.   8 o   427 at 5s. 9d.	$2d. \left  \frac{1}{120} \right  246 \text{ at } 175. 106$
128,2 0 56 9 fubtract	221 8 3 fubira
£. 122 15 3	£. 219 7

Answer, Net Wt. 141 2 17

Answer, Net Wt. 22 2 7

(3) C. 
$$gr$$
.

Grofs,
Tare,
$$\begin{array}{ccc}
C. & gr & lb \\
2 & 3 \\
2 & 2lb \\
\end{array}$$
 $\times$  8 Frails.
$$\begin{array}{cccc}
C. & gr & lb \\
= 22 & - \\
= 1 & 2 & 8
\end{array}$$

Answer, Net Wt. 20 1 20

(4) Grofs Wt. 
$$\frac{C. qr. lb.}{3 - 27}$$
  $\times 5 \times 8(40)$   $\begin{cases} = 129 & 2 & 16 \\ = 6 & 1 & 20 \end{cases}$ 

Answer, Net Wt. 123 - 24

(5) C. qr. lb. C. qr. lb. oz. Grofs Wt. 2 1 17
$$\times$$
2 $\times$ 11(22 Barrels)=52 3 10 — Tare 14lb. per Cwt. is  $\frac{1}{8}$  = 6 2 11 12

Answer, Net Wt. 46 0 26 4

```
136
```

## Tare and Trett.

(10)

216

(11)

(12

(6) Grofs Wt. 6C, 2qr. 12lb. 
$$\times$$
 9d. s.=59C. 1qr. 24lb.  $\frac{1}{8}$  59 1 24 Grofs.  $\frac{1}{7}$  7 1 20 8  $\frac{1}{2}$  1 0 6 14 $\frac{6}{7}$ 

9 0 2 142 Tare.

73

Answer, 50 1 21 15 Net Weight.

0

2 3

C.qr.lb. G. qr. lb.

Grofs, 2,3,27, ×3×9(27 Bags)=80 3 1 (8) 1616. 7 80 3 I Gross. 8 11 2 4 2 Tare, supposing it had been 16th. 2 3 5 8 2 3 15 0 24 12 0 2 1 13 13 10 Tare. 9

41... 71 1 15 2 6 Suttle.
2 2 27 8 1 6 Trett.

Answer, 68 2 15 10 417 Net.

(9) 2lb. 12 5647 3 13 Grofs. 33 2 13 41 Cloff.

Answer, 5614 0 14119 Net.

(10) 
$$C. qr. lb.$$

$$2lb. \frac{1}{168} \begin{cases} 3)42 & 3 & 0 \text{ Grofs.} \\ 7)14 & 1 & 0 \\ 8) \hline 2 & 0 & 4 \\ \hline 0 & 1 & 0 & 8 \text{ Cloff.} \end{cases}$$

Answer, 42 1 27 8 Net.

(12) C. qr. lb. 16lb.  $\frac{1}{7}$  20 3 13 Grofs. 8  $\frac{1}{2}$  2 3 25 13 $\frac{5}{7}$  Tare, supposing 16lb. per C. 1 1 26 14 $\frac{6}{7}$  Tare. 4  $\frac{1}{26}$  19 1 14 1 $\frac{1}{7}$  Suttle. 2 2 7 7 Trett. 2  $\frac{1}{168}$  18 2 14 10 $\frac{1}{7}$  =Second Suttle. 0 0 12  $6\frac{2}{7}$  Cloff.

Answer, 18 2 2 3 6 Net.

N 3

(13) d. C. gr. lb. f. s. Neat proceeds, 4 14 6 10 9 3 10 Gross. Custom, &c. o 3 26 Tare. 8 6 Freight, 2 Factorage. 9 C. 8 3 114Net=4959 Fifths. - And 1 C .= 560 Ditto. f. 8 10 5=2045 Pence.

Stated thus—If 4959: 2045:: 560

4959)1145200(230 $\frac{3}{4}$ d. $\frac{3643}{4959}$ , or £.0 19s.  $2\frac{3}{4}$ d. $\frac{3}{59}$ , the Answer.

First,  $1180 \times 80 = 94400$  Inches, which,  $\div$  by 231, (the Number of Inches in a Gallon) gives  $408\frac{13}{23}\frac{2}{3}$  Gallons; these  $\times 7\frac{1}{2}lbs$ . the Number of lbs. in a Gallon) gives  $3064\frac{215}{23}lbs$ . Gross, which  $\div$  by  $10 = 306\frac{11}{23}lb$ . Tare; this, taken from the Gross,  $=2758\frac{10}{23}lb$ . Neat.

Then, stated thus—As 112lb.: 4s. 6d. or 54d. :: 275 $\frac{8}{2}$  132 $\frac{3}{4}$ d.  $\frac{22}{25}$   $\frac{32}{32}$ , or £.5 10s.  $\frac{9}{4}$ d.  $\frac{22}{25}$   $\frac{32}{32}$  the Answer.

### 18. SIMPLE INTEREST.

- (1) First, £.824 18s. 2d Principal, X by 4, Rate per Cent. =£.3299 12s. 8d. which ÷ by 100, gives £.32 19s. 11d. 3/2, the Answer.
- (2) First, 500f. ÷2,0=25. Interest for 1 Year; this X by 4, (the Number of Years)=100f. the Answer.
- (3) First, £.264 os. 4d. ÷20=£.13 4 4\frac{4}{5} Interest for.1

  Year, this × by 12 (the Time) £.158 8s. 2\frac{1}{4}d.\frac{1}{5}

  Interest; which, added to the Principal, gives
  £.422 8s. 6\frac{1}{4}d.\frac{3}{5} the Amount required.
- (4) First, £.246 Y8s. ×41=£.1049 6 6 which: 100= £.10 9 101 25 the Interest required.
- (5) First, £. 140 10s. × 4½ = £.632 5s od.÷100= £.6 6s. 5¼d. ⅓ Interest for a Year, which × by 7, = £.44 5s. 1¾d. ⅙ Interest for 7 Years, the Answer.

(6)

(7)

(8)

(9)

(11)

1

Aní

(6) First, £.470×3\(\frac{3}{4}=\)£.1762 10s.\(\frac{1}{100}=\)£.17 12s. 6d. Interest for a Year; which × 5=£.88 2s. 6d. Interest for 5 Years; this added to the Principal, viz. £.470=£.558 2s. 6d the Amount required.

(7) First, £.474 14s. 6d.  $\times 3\frac{1}{4} = £.1542$  17s.  $1\frac{1}{2}d$ . this  $\div$  by 100, gives £.15 8s.  $6\frac{3}{4}d$ .  $\frac{21}{5}$  the Commission

required.

(8) First,  $2\frac{1}{2} = \frac{1}{45}$ , Then £.74,2 125. 6d.  $\div$  4,0=£.18 115.  $3\frac{1}{4}d$ . the Answer.

#### BROKERAGE.

(9) First, £.420 128. 6d. 
$$\div$$
 100=£. 4 48.  $1\frac{1}{2}$ d.  
£. s. d.  
45.  $\frac{1}{5}$  4 4  $1\frac{1}{2}$   
0 16  $9\frac{3}{4}$   
2  $\frac{1}{2}$  0 8  $4\frac{3}{4}$   
4d.  $\frac{1}{6}$  0 1  $4\frac{3}{4}$ 

Answer, f. r 6 71 Brokage.

(10) First, 
$$1000f$$
.  $\div 100 = 10f$ . Then s. d.  $f$ .

4 0  $|\frac{1}{5}|$  10 at 4s. 6d.

6  $|\frac{1}{8}|$  2 0

0 5

Answer,  $f$ . 2 5

(11) First, £.540 10s. 
$$\div$$
 100

=£.58s. 1d. then

s. d. £. s. d.

10 0  $\frac{1}{2}$  5 8 1 at 13 10 10 0  $\frac{1}{2}$  24 14 11 at 19  $9\frac{1}{2}$ 

Answ. £.3 14  $8\frac{3}{4}$ 

(12) First, £.2474 15s.  $\div$  100

=£.24 14s. 11 \frac{1}{4}d. then

s. d. £. s. d.

10 0  $\frac{1}{2}$  5 8 1 at 13 10 10 0  $\frac{1}{2}$  24 14 11 \frac{1}{4} at 19  $9\frac{1}{2}$ 

8 4 11 \frac{1}{4}

7 \frac{1}{4}

9 15 5 \frac{1}{2}

15 5 \frac{1}{2}

16 5 5 \frac{1}{2}

Answ. £.24

#### INSURANCE.

(23)

(24)

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25) ]

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- (13) First, 14,60f. ÷100=£.14 12s. Then, £.14 12s. ÷8(2s. 6d.=\frac{1}{8})=£.1 16s. 6d. Insurance required.
- (14) First, £.2460×10\(\frac{3}{4}=\)£.26445, which \(\div \)100=\(\frac{1}{2}.264\)
  gs. the Infurance required.
- (15) First, £.2500×67=£.17187 10s. which: by 100= £.171 17s. 6d. the Insurance required.
- (16) First, £.7406 17s. 6d. × 15\(\frac{3}{4}\)=£.1166 11s. 7\(\frac{3}{4}\)d. which:\(\frac{1}{100}\)=£.116 11s. 7\(\frac{3}{4}\)d. \(\frac{1}{2}\) the Infurance required.

### PURCHASING of STOCKS.

- (17) First, 400 f. × 20 1/4 : 100 = 81 f. Then, 400 + 81 = 481 f. the Purchase required.
- (18) First,  $f.470 \times 87\frac{3}{4} = 41242f.$  10s. which : by 100= f.412 8s. 6d. the Purchase required.
- (19) First, f.2470 17s. 10d.  $\times 3\frac{1}{2}$  (the Excess) = f.8648 2s. 5d. which,  $\div$  100=f.86 9s.  $7\frac{1}{4}d.\frac{96}{100}$ ; this, added to £.2470 17s. 10d. the Stock, gives £.2557 7s.  $5\frac{1}{4}d.\frac{246}{2500}$  the Answer.
- (20) First,  $876f imes 14\frac{5}{8}$  (the Excess)=f. 12811 10s. which  $\div$  by 100=f. 128 2s.  $3\frac{1}{2}d$ .  $\frac{4}{10}$ ; this, added to 876f. the Stock, gives f. 1004 2s.  $3\frac{1}{2}d$ .  $\frac{2}{5}$  the Purchase required.
- (21) First, 427£. 10s.×4÷100=17£. 2s. Then, 17£. 2s.÷3 (4 Mo.=\frac{1}{3})=5£. 14s. the Interest required.

(22) 
$$f \cdot f \cdot s \cdot d$$
.  
 $5 = \frac{1}{20} = 246 = 12 = 6$   
1 Year  $\frac{1}{4} = \frac{12}{4} = \frac{6}{3} = \frac{7\frac{1}{2}}{1}$  Interest.  
Answer,  $f \cdot 15 = 8 = 3\frac{1}{4} = \frac{1}{2}$ 

(23) 
$$\int_{\frac{3}{20}}^{\frac{1}{20}} \frac{18}{10 \quad 9 \quad 10\frac{3}{4} \quad \frac{1}{5}}{\frac{1}{5}} \text{ Subtract.}$$

$$\frac{3}{4} = \frac{1}{20} \quad 10 \quad \frac{3}{4} \quad \frac{1}{5} \quad \text{Subtract.}$$

$$\frac{3}{2} = \frac{1}{20} \quad 10 \quad \frac{3}{4} \quad \frac{1}{5} \quad \text{Subtract.}$$

$$\frac{1}{2} = \frac{1}{20} \quad 10 \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{3}{5} \quad \frac{4}{5}$$

$$\frac{3}{2} = \frac{1}{20} \quad 10 \quad \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{1}{20}$$

$$\frac{3}{4} = \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{1}{20}$$

$$\frac{3}{4} = \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{1}{20}$$

$$\frac{3}{4} = \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{3}{5} \quad \frac{1}{20}$$

$$\frac{3}{4} = \frac{1}{20} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{$$

Answer, £.254 15 4 1

(24) £. 
$$f$$
. s. d.

5  $\frac{1}{10}$  604 17 6

 $\frac{1}{2}$   $\frac{1}{10}$  30 4  $\frac{10\frac{1}{2}}{3}$  3 0  $\frac{1}{3}$   $\frac{3}{3}$  6 Mo.  $\frac{1}{2}$  33 5  $\frac{1}{4}$   $\frac{3}{5}$  3

99 16 1- $\frac{4}{5}$ =3 Years Interest.

8 6 4- $\frac{1}{5}$ =3 Ditto.
604 17 6 Principal.

Answ. £. 789 12 71 the Amount.

25) First, 400 £. 155 × 4 ÷ 100=£.16 0 7 5 Interest for 1 Year. Then

w. £. s. d. w. £. s. d.

\$52: 16 0 7 :: 4: 1 4 73 the Interest required.

26) First, 600×3\[\frac{3}{4}=22.50\interest\]. this \(\frac{1}{2}\) by 1,00=\(\interest\).22 10s. the Interest for one Year.

(27) First, 740£. ÷20=37£. Interest for a Year; then
If 52W.: 27£.: 42W.

If 52W.: 37£.:: 42W.

Here 37 × 42=1554£. these ÷ by 52=£.29 17s. 8½d. 3

the Interest for 42 Weeks, which, added to 37£.×4,
viz 148£. the Interest for 4 Years, gives £.177 17s.
8¼d. 3³3, the Interest for 4 Years, 42 Weeks, the Answ.

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(28) First, 200£. × 4½=900£. -100=9£. Interest for a Year; which × 5=45£. Interest for 5 Years; then

Here  $9 \times 50 = 450 f$ .  $\div 52 = f$ . 8 13s.  $0\frac{3}{4}d$ .  $\frac{9}{13}$ , Interest for 50 Weeks; which added to 45f. the Interest for 5 Years, gives f. 53 13s.  $0\frac{3}{4}d$ .  $\frac{9}{13}$ , the whole Interest; this added to 200f. = f. 253 13s.  $0\frac{3}{4}d$ .  $\frac{9}{13}$ , the Amount required.

(29) First, 200 × 31/2:100=7£. Interest for 1 Year.

Now, 73 Days,= f of 1 Year.

Therefore 7£. ÷ 5 gives £.1 8s. ol. the Interest required.

(30) First, £.340 10s. ÷ 20=£.17 0 6 the Interest son

Year.

And from January the 1st, to July the 18,=199 Days by the Table; or fee Q. 1. P. 29; then,

D. £. s. d. D.
If 365: 17 0 6:: 100

Here £.17 os. 6d.=4086 Pence; these × 199=813114 which:  $\frac{365}{365}$ =2227 $\frac{1}{2}d.\frac{306}{365}$ , or £.9 5s.  $7\frac{1}{2}d.\frac{30}{365}$  Answ. (31) First, 500£.×4=2000 : 100=20£. Interest for

Year.
And from December the 4th, 1789, to March the 10th
1791=1 Year, 96 Days; then

D. f. D. If 365:20:96

Here  $96 \times 20 = 1920 f$ . this = 365 f. 5 5s.  $2\frac{1}{4}\frac{3}{3}\frac{15}{65}d$ . Interest for 96 Days; which, added to 20 f. (Interest for Year)=f. 25 5s.  $2\frac{1}{4}d\frac{3}{3}\frac{15}{65}$ , the Interest required.

(32) First, £ 4 10s. Rate×9½ Year's Time=£.42 15 Interest of 100£. for 9½ Years; which Interest adds to 100£.=£.142 15s. the Amount; then,

£. s. £. £. s. If 146 15: 100:: 856 10

Here £.142 151,=2855s. and £.856 10s.=17130s. while ×100=1713000£. these 2855=600£. the Answer

(33) First, 3£. Rate, × 7<sup>3</sup>, Time = £.235s. Interest which, added to 100, Principal, = £.123 5<sup>5</sup>. Amount; then,

f. s. f. f. s. d. If 123 5: 100 :: 614: 3 11

Here f. 123 55 = 29580d. and f. 614 35. 11d = 147407d. X 100=14740700f. ÷29580=f.498 6s. 8d. the Answ.

(34) First, £.600×4=2700£ =100=27£. Interest of 600f. for a Year; and from f.856 10s. take 600f. remains 256f. 103. Interest of toof. for the whole Time; then,

£. 1. £. s. If 27:1:256 10 20

)513,0(91 Years, Answer. 54,0 (35) First, £.498 6s. 8d. ×3=£.1495 this: 100=£.14
19s. Interest of the given Principal for a Year; then
from £.614 3s. 11d. take £.498 6s. 8d. leaves £.115 175. 3d. Interest of the Principal for the whole Time; then,

> f. s. 1. f. s.d. If 14 19: 1 :: 115 17 3

Here £.14 19s.=3588d. and £.115 17s. 3d.=27807d.

which - 3588 = 7\frac{3}{4} Years, the Answer.

(36) First, from £.856 10s. take 600£. Remains £.256 10s. Interest of the 600f. for 91 Years.

£. S. S. If 600: 256 10 or 5130:: 100

6,00)5130,00(855s. Interest of 100 £. for 9½ Years, which ÷ 9½, viz. 19 Half-Years, gives 45s. or £.2 5s. Interest of 100 £. for Half a Year, which × 2=f.4 10s. per Cent. the Answer.

(37) First, from £.61435.11d. take £.4986s.8d. Remains £.115 175. 3d. Interest; then,

£. s. d. £. s. d. £. If 498 68: 115 17 3:: 100 Reduced, 119600d.: 27807:: 24000d. 24000

1196,00)6673680,00(5580d. or 465s. And 73=31 Qrs. then 31)465(155. × 4=3£. per Cent. the Anfwer.

(38) First, 5000f. × 41=225,00f. -1,00=225f. Interest for a Year; which  $\div 4 = \pounds.56$  5s. Interest due to Lady. Day, which is a Quarter, and in this Manner proceed with each new Principal for the Interest. 1789. Christmas, lent 5000 at 41 per Cent. 1790. Inter. due to Lady-D. 56 Amount. 5056 5=185 Guineas. Drew out 194 4862 Remains o New Principal, Interest of which to Mids. 54 13 114 Amount. 4916 13 114 Paid in 500 Moidores,= 675 Sum, 5591 13 114 Drew out. 700 Remains, 4891 13 114 New Principal. Interest to Michaelmas. 55 72 Amount, 4946 14 63 Paid in Part. 569 17 Answer, £.5516 11 63 Pro-(39)ducts. 1789. 1. Lent per Bill at one Day's Date, May 500 13 6500 13. Received in Part, 50 Balance, 450 22 9900 June 4. Received in Part, 56 Balance, 394 40 15760 July 14. Received in Part, 44

Balance,

Carried over, Sum 35310

350 9

3150

Aug

Sep

0.9

Nov

Dec

The

To : Feb.

Mar

Apr

School E		ſ	Days	Pro- ducts.
	rought over		RESTRUCTION OF	5310
23. Received in Part,	ALCO TO SE	50		
Balance, — Aug. 18. Received in Part,		300		7800
Balance, 30. Received in Part,		21 1	3 12	2556
Balance, — Sept. 21. Received in Part,	- 1137 = 10	20 3	0 22	4400
Balance, ————————————————————————————————————		17 3	0 27	4590
Balance, 29. Received in Part,		14	0 1 1	1540
Balance, — Nov. Lt. Received in Part,		10	013	1300
Bálance, — Dec. 28. Received in full of Pr	rincipal,	5 5	047	2350
1	Sum of the	Produ	-1 '- cts, !	9846
Then, 73,00)598,46(8£. 35. 1 Account.	13d.730 1	nterest	due	on this
(40)		Day		ducts.
To a Bill at one Day's Date, Feb. 27. Received in Part,	878 19 57 15	1040	35159	s. d.
Balance, — Mar. 18. Received in Part,	821 4 37 14	319	15605	3 0 9
April an Passived in Port	783 10 34 11	3 42	32907	10.6
April 29. Received in Part,		W. School St. Land St.		

Red

July Till

(42)

The

(43)

The Inte

May

2d E

Sept.

ad B

Sept.

The

May	12.	Balance, — Received in Part,	£. 748 136	19	3	400000	Prod £. 93406	5.	1
June	19.	Balance, - Received in Part,	612			58	23262	19	•
July	15.		544 15				14157	8	8
	5.	Balance, — Received in Part,	528 111	14	10	10	5287	8	1
Oct.	3•	Balance, — Received in Part,	417	7	1 I 4	70	29200	4	•
Nov.	19.	Balance, — Received in Part,	338			47	15922	12	5
		Balance,	238	12 x 27 2	Contract Contract	4	955	2	4
Dec.	30	Received in full of the Principal.	138	30		37	5134	16	1

Sum of the Products, £. 187327 6 8

Then 73,00)187347£. 6s. 8d. (25£. 13s. 21d. 634, the Interest required.

(41) First, from 109 Meidores take 2s. 6d. Rem. 147 0 6
Amount of the Bond,
And 109 Guineas — = 114 9 0

Difference or Intereft, L. 32 11 0

Also, f. 114 gs. Principal, X 4 Rate, = f.4,57 16s. this

L. s. d. Yea. L. s. d.

Then—If 4 11 6½: 1:: 32 11 6

Reduced. 2197 Halfpence: 1:: 15636 Halfpence; therefore
2197)15636(7 Years, 42 Days, the whole Time.

July hath 31 Days
Till August 18th.

Sum 49—42=7th of July, the Ans.

(42) First, £.39 19s. 8d.=9596 Pence; then per Sect. 15.

Placed thus, { 100 : 12 :: 9596

Then 240 × 12 × 100=288000 Dividend, which by 9596 1 =30 Years, 4345 Days, the Answer.

a PARTE DE LOCCOCACOSTA (OF TYREE P

(43) First, from Aug. 7, 1778, to May 11, 1781=2 Years, 277 Days.

The 1st Bond was made for 1114 10 0 at 6 per Ct. Interest of which for a Y. 279 D. is 184 9 95

Sum, 1298 19 92 Amount.

May 11, Paid off, — 140 0 0

2d Bond, — 1158 19 93

Due Sept. 19, — 21 16 8

Sum, 1180 16 53 Amount. Sept. 5, Paid off, 87 11 9

3d Bond, — 1093 4 83 } fubt.

Interest, 316 12 03

Then, from September 19, 1781, to September 19, 1789, =
7 Years, 357 Days, or 2912 Days, 3d Bond or Principal, viz. £.1093 4s. 8d. = 262376 Pence, £.316 12s. od.
=303956 Furthings, and a Year=365 Days; then,
by Cafe 6, or rather by Sect. 15; thus—

# Simple Interest.

Sold

Inter

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Inter

Divi

Inter

Divi

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Sold

Brok

To

Prin. Time. Interest.			
392376 2912 :: 303936	71-10-11		
24000 365 ::	eli care.	. Con	UL-Y
Then 262376×2912=764038912 the Divil	or.	016	
And 303936×365×24000=266007936000	oo the Div	rider	nd.
Therefore, 764038912)2660079260000(34	181 4599	390	18
Farthings, or £.3 125. 64d. the Aniwe	r required	d.	
The Time of the 2d Bond's Continuance is	found, th	nus-	35
r. Time. mr. of the qr	s. D. d.		
P. Time. Int. 97 100 365 5 5 0 Red. 27 1158 19 9 21 16 8 Red. 27	305	12	00
Then 278157 × 1260=350477820 the Divi	for	52	40
5240×365×2400=45902400000 th	101,	-	
350477820)4590240000(131 Days n			av
11, which Answers to Sept. 19, as before			
The state of the s			1,61
(4)	The state of the s		
(172)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.15	- 1
If he puts in ) 200 (to have ) 40 (	r Year		717
200 (to have ) 55 ( pe			
the state of the s			
If he puts in $\begin{cases} f. \\ 100 \\ 200 \\ 300 \end{cases}$ to have $\begin{cases} f. \\ 40 \\ 55 \\ 70 \end{cases}$ per $\begin{cases} f. \\ 55 \\ 70 \end{cases}$ take $\begin{cases} f. \\ 40 \\ 55 \\ 70 \end{cases}$ Then from $\begin{cases} f. \\ 55 \\ 70 \end{cases}$ take $\begin{cases} f. \\ 40 \\ 55 \end{cases} = 15 \text{ per C.}$	for his N	Mon.	71.
[40]	2 - 4		17
[2] 20 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 (2) 2 [2] 2 (2) 2 (2	1:- A		
And { 55 } - { 30 } = 25 f. per Year for	nis Atter	idan	ce.
And $\begin{cases} 55 \\ 70 \end{cases}$ $= 25 \mathcal{L}$ per Year for	his Atten	ıdan	ce.
And $\begin{cases} 40 \\ 55 \\ 70 \end{cases} - \begin{cases} 15 \\ 30 \\ 45 \end{cases} = 25 \mathcal{L}$ . per Year for	f.	s.	ce.
First 900s. at 1113 per Cent. per Case 2.	£. =1002	s. 7	ce.
(45)	£.	s. 7	ce.
First 900s. at 1113 per Cent. per Case 2.	=1002	s. 7 2	d. 6 6
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.	=1002	s. 7 2	d. 6 6
First 900s. at 1113 per Cent. per Case 2.	£.1002 =1 £.1003	s. 7 2	d. 6 6
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.	£.1002 =1 £.1003 18	s. 7 2 10 0	d. 6 6 0 0
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.  Midsummer Dividend, at 2 per Cent.	=1002	s. 7 2 10 0	d. 6 6 0 0
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.  Midsummer Dividend, at 2 per Cent.  Interest of £.1003 10s. for 49 Days, at 5	$ \begin{array}{c}                                     $	s. 7 2 10 0	d. 6 6 6 0 0
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.  Midsummer Dividend, at 2 per Cent.  Interest of £.1003 105. for 49 Days, at 5	£.1002 =1 £.1003 18 £.985 6	s. 7 2 10 0	d. 6 6 6 0 0 8
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.  Midsummer Dividend, at 2 per Cent.  Interest of £.1002 105. for 49 Days, at 5	£.1002 =1 £.1003 18 £.985 6	s. 7 2 10 0	d. 6 6 6 0 0 8
First 900 £. at 1113 per Cent. per Case 2.  Brokerage of Ditto, et 25. 6d. per Cent.  Midsummer Dividend, at 2 per Cent.  Interest of £.1003 105. for 49 Days, at 5	£.1002 =1 £.1003 18 £.985 6	s. 7 2 10 0 14 10	d. 6 6 6 0 0 0 8 0 0

Count number of the country		100
Sold 400£. at 92½ per Cent.	THE RESERVE OF THE PARTY OF THE	. 0
Interest for & Year, due Feb. 10, 1746.	622 1	4 8 i 4 <del>1</del>
Dividend received at that Time,		6 0
Interest due to Agust 10, 100 bile 20 01	TOO A	6 ol
Dividend received at that Time, A = 8 1 x	200	0 2
Interest due to Feb. 1747,	634	7 0
Dividend received then,	649 1	7. 2
Interest to the roth of August,	CONTRACTOR DESIGNATION	7 2 9 11
Midfummer Dividend, received August 10,	655 1	7 I
Sold off 500 f. at 102 per Cent.	645 1 512	7 6
Brokerage, — 19 3 3	133 1	4 7
To my Damage in the whole,	f. 133	2 I
os ab gentlecond Year's Perfection.	2 Ar	8
the state of the s		

### (19) COMPOUND INTEREST.

of nach per Exula

(1)

L. L. s. 5 = 16 Year's Principal. 30 0 0= Interest.

5 25 630 0 0=second Year's Principal.

5 26 661 10 0=third Year's Principal.
33 1 6=----- Interest.

694 II 6=Amount. 600 0 0=Principal.

Answer, £. 94 11 6

First, 150 £. × 4 = 6,00 £. ÷ 100 = 6£. Interest, which added to 150=156£. second Year's Principal; then 156£. × 4 = 624£. ÷ 100 = 6£. 4s. 9½d. Interest, † 156£.=£.162 4s. 9½d. third Year's Principal, which × 4,=£.648 19s. 2d. ÷1,00=£.6 9s.9½d. Interest, which added to £.162 4s. 9½d.=£.168 14s. 7d.=fourth Year's Principal, which × 4, = £.674 18s. 4d. ÷100=£.6 14s. 11d. fourth Year's Interest, which added to £.168 14s. 7d. =£.175 9s. 6½d. = fifth Year's Principal, which × 4,=£.701 18s. 3d. this ÷100 £.7 0s. 4½d. fifth Year's Interest, which, added to £.175 = 9s. 6½d.=£.182 9s. 11¼d. the Amount required.

(3) £. s. d.

5 23 440 16 0 = 1st Year's Principal.

22 0 92 = Interest.

5 26 462 16 95=fecond Year's Principal.
23 2 10 = Interest.

5 36 485 9 74=third Year's Principal.
24 5 112=----- Interest.

### 20. REBATE or DISCOUNT.

£. £. £. £.

6 Mo. \(\frac{1}{2}\) 5 Then as, 103 : 3 :: 420 : £.12 4 7\(\frac{1}{2}\) 7\(\frac{1}{2}\) 10

1 6 D. \(\frac{1}{5}\) 2 10

0 10

3 0 0 Interest.

100 0 0 Principal.

6.103 0 0 Amount of 100 £. for the given Time.

(2) First, 100+6=106 f. Amount of 100 f. for a Year. Then—If 106 f.: 100 f.:: 100 f.

Delcours of Half for S Menths, which, added so that

106)10000(£.94 6s. 94d.33 Answer.

or a bloothe given five or, while Antiwer.

Int.for10M.3 6 8 present Worth, which taken Principal, 100 0 0 from the Principal, leaves £.19 7s. 5d. Answer.

Amount, 103 6 8

(4) First, from December 12, to July 27, =227 Days.
Then—If 365D.: 5(.:: 227 Days.

365)1135(6. 3 25. 21d. Rebate of 100[.

for 227 Days.

£. s. d. £. s. d. £. s.

Again.—If 103 2 2\frac{1}{4}:3 2 2\frac{1}{4}:: 890 16

Or, 98985 qrs.: 2985 qrs.:: 855168 qrs.

855168

98985)2552676480(25788 qrs. or £.26 17s. 3d. the Answer.

(5) First, one half of 430 £. = 215 £.

Mo. £. £. s. d. £. s. d. £.

4 \frac{1}{3} 5 If 101 13 4:1 13 4:: 215

Interest, 1 13 4 24400d.: 400d.:: 51600d. Prin. 100 0 0 51600d.

Amt. 101 13 4 244,00)206400,00(845\frac{1}{2}d. or £.3 10s.

5\frac{1}{2}d. Difc. of one half for 4 Mon.

Again, £.1 13s. 4d.\(\times = £.3 \text{ 6s. 8d. Interest for 100}\xi\$. for 8 Months.

£. s. d. £. s. d. £.

Then—If 103 6 8 : 3 6 8 :: 215

or, 24800d. : 800d. :: 51600d.

51600

248,00)412800,00(1664\frac{1}{2}d. or £.6 18s. 8\frac{1}{2}d.

Discount of Half for 8 Months, which, added to that for 4 Months, gives £.10 9s. 2\frac{1}{2}d. Answer.

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Rebate and Discount.
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(6) First, from May 21, to Christmas,=218 Days; then-
     If 365D. : 5f. :: 218 Days.
  365) 1090(£.2 195. 8½d. Interest of 100£. for 218

Days. £. s. d. £. £.

Again,—If 102 19 8½: 100:: 550
       or, 9886qrs. : 100 :: 528000qrs.
                   528000
             9886) 52800000 (£.534 13. 14d. Answer.
                       £. s. £. £.
(7)
    Mo.
                 then-101 10: 100: 100
     3 4
Interest, 1 10 or If 2030s.: 100:: 2000s.
Prin.
     100
                           2000
                  203,0)20000,0(£.98 10s. 5\frac{1}{4}. prefent Worth of 100£, for 3
Amt.
      101 10
                        Months. - Again,
      Mo. £.
                          f. s. f. f.
                then-If 102 10 : 100 :: 60
     4 3 6
                                £.
          2
             0
                 or-If 2050s. : 100 :: 1200s.
       0 10
                              1200
Interest, 2 10
                      205,0)12000,0(£.58 10s. 83d.
Principal, 100 0
                         present Worth of 60f. for 5 Months.
Amount, 120 10
Now, 100+60=160f. And 3220f. - 160f.=3060f.
    for 9 Months.
    Mo. L.
                      s. f. f.
   6 3 6
           If 104 10: 100 :: 3060
           Or, 2090s. : 100 :: 62200s.
Interest, 4 10
               209,0)6120,0(£.2928 4s. 7d. prefent
                 Worth of 3060f. for 9 Months; there-
Prin.
      100 0
                 fore all the present Worths, added
                 together, will be £.3035 53. 9d. the
Amt. 104 10
```

Answer.

Now all the present Worths added together gives £.390 15s, 9\frac{1}{2}d. which, taken from 400£. Value of the Goods, leaves £.9 4s. 2\frac{1}{2}d. the Rebate.

(9) First,  $\frac{1}{3}$  of 360£.=120£. to continue 5 Months.

4 ± 3 then-If 101 5: 100:: 120

1 ½ 1 0 2025s.: 100:: 240s.
0 5 2025)24000(L.118 10s. 4¼d. the
present Worth of 120L. for 5
Months.

Princip. 100 0
Amount, 10 1 5

Again, 360—120=240£. to continue 10 Months.

Mo. £. £. £. £. £.

6 \( \frac{1}{2} \) 3 then—If 102 10: roo: 240

4 3 1 0
Interest, 2 10
Princip. 100 0

Amount 102 10

Worth of 240£. for 10 Mo.

which, added to that for 5 Mo. will
make £. 352 13s. 3\frac{1}{3}d. the present
Worth required.

## (10) 5£. 20 500£. Principal.

salle & Gar

25 Interest of 500s. for one Year; then 25s. × 12=300s. Interest for 12 Years.

Again, 5 × 12=60s. Interest of 100s. for 12 Years.

Then, As, 160s. 60s. 500s. 187s. 10s.

300s.—187s. 10s.=112s. 10s. Advantage to Interest.

(ii) is in a color Mo. f. 3. d. then-If 112f. 6s. 81d. : 100f. 14 7 6=4 36. :: 133776. 135 4d. 2 or, 107841 qrs.: 100:: 12842560 qrs. — 107841(1284256000(£.11908155.94d. 107844, the reay Money required. 8 15 0 3 9 15D. 1 104/01/14/2 3 74 5 Inter. 12 18 6 Prin. 100 0 0, ( b) 0 LAN FORESTON VEST COM

S 838 1118

### 21. EQUATION OF PAYMENTS.

(1) f. Mo. Prod.  $200 \times 3 = 600$   $150 \times 4 = 600$   $250 \times 6 = 1500$  6,00) 27,00(2) f. Mo. Prod.  $200 \times 7 = 1400$   $260 \times 5 = 1300$  46,0) 270,0(5M.  $26,\frac{4}{46}D.$ Answer 5M.  $26,\frac{2}{23}d.$ 

Answer 4 Months 15 Days.

(3) He suppose 120f. to be the sum owed.

£. Mo. Prod.

then 
$$\frac{1}{3}$$

$$\frac{1}{6}$$

$$\frac{1}{20} = \begin{cases} 60, \times 3 = 180 \\ 40, \times 4 = 160 \\ 20, \times 9 = 180 \end{cases}$$

12,0 )520(4 Mo. 10 D. Answer.

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(4) Here, as the Debt is to be had at four equal Payments, and \(\frac{1}{4}\) being paid down, there remains \(\frac{3}{4}\) to be paid, at three equal Payments; confequently, the Sum of the different Times that each Payment is to be made, being divided by 3, will give the Answer, thus

4+5+6=15, this  $\div 3=5$  Months the Answer. (5) f. Mo. Prod.  $\cdot$ Owed,  $240\times 5=1200$ Paid down, 40

Remains, 20,0)12,00(6 Months, the Answer.

22. SINGLE FELLOWSHIP.

(1) First, 80+60=140f. their Stock.—Then,

£. £. £.

As 140: 28:: \{ 80: 16 A's \} gain

(2) First, 320+340=660 £. G and D put in; then, from 824 £. take 660 £. remains 164 £. E's Stock, and 824 +70=894 £. their whole Gain; therefore, £. £. s. d. Rem.

```
(3) Here, suppose 600 £. to be their Stock; then
                                                                       £.
                     (300A.'s)
                                            Stated thus.
                                                                      300
                      200B.'s Stock. f. f. f. 150 C.'s
                                                                      200
                                                                     (150
                      770 Sum.
                                    Anfw. as below.
  By Fractions, thus -\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, and \frac{1}{5}, -\frac{60}{120}, \frac{40}{120}, \frac{30}{120}, and
120. Then 60+40+30+24=154.

\begin{cases}
60: 46 & 15 & 0\frac{3}{4} & 9A.'s \\
40: 31 & 3 & 4\frac{1}{2} & 6B.'s \\
30: 23 & 7 & 6\frac{1}{4} & 43C.'s \\
24: 18 & 14 & 0\frac{1}{4} & 19D.'s
\end{cases}

Lofs.
(4) First, 30+48+42=120 f. their whole Gain.—Then
         As 120: 400:: \\ \\ \frac{30: 100 D.'s}{48: 160 E.'s}\\ \\ \text{Stock.}
                                242: 140 F.'s
      (5)
                   £.
                            ==20000 A.)
         First, 1000
                            =12800 B. ( Debt.
                  640
                            =18000 C.
                   842 16=16856 D.
        Sum, 3382 16=67656, the whole Debt.
And 2420£ 175. 6d .= 581010 Pence, his whole Worth.
            Then,
                                              d.
                                                          £. s. d.
                              20000: 171754 =715 12 10
As, 67656: 581010 :: ) 12800 : 109922= 458
                             \begin{cases} 18000 : 154578\frac{1}{4} = 644 & 1\\ 16856 : 144754\frac{1}{4} = 603 & 2 \end{cases}
         Rem.
         45504 A.
         45360 B. Received.
```

360 C 44088 D. (6) Here, suppose 420, as it will divide by 3, 4, 5, 6, and by 7, and have no Remainder, then \( \frac{1}{3} \) of 420=140 A,\( \frac{1}{6} = 70 \) D, and \( \frac{1}{7} = 60 \) E, therefore, added together, \( = \frac{45}{420} \), then neglecting the Denominator, the Statings will stand thus:

 $\begin{array}{c}
\text{L.} & \text{f. s. d.} \\
\text{140: } 152 \text{ 10} & 1\frac{1}{4} \text{ 105 A.'s} \\
\text{105: } 114 & 7 & 6\frac{3}{4} \text{ 423 B.'s} \\
84: & 91 \text{ 10} & 0\frac{3}{4} \cdot 63 \text{ C.'s} \\
70: & 76 & 5 & 0\frac{1}{2} \text{ 282 D.'s} \\
60: & 65 & 7 & 2\frac{1}{4} & 45 \text{ E.'s}
\end{array}$ Share.

Or by Fractions, thus,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{1}{5}$ ,  $\frac{1}{6}$ , and  $\frac{1}{7}$ ,  $\frac{820}{2520}$ ,  $\frac{630}{2520}$ ,  $\frac{524}{2520}$ ,  $\frac{420}{2520}$ , and  $\frac{390}{2520}$ . Here neglecting the Denominator, and the Sum of the Numerators will be the first Term, and each Numerator the third; then proceed as above, will give the Answer.

(7) First,  $\frac{3}{8} + \frac{3}{7} = \frac{21}{56} + \frac{24}{56} = \frac{45}{56} A + B's = Part$ . Then,  $\frac{56}{56} = \frac{45}{56} = \frac{11}{56}$  C.'s Part; then by neglecting the Denominator.

As 11: 140::  $\begin{cases} £. & £. & s. & d. \\ 21: 267 & 5 & 5\frac{1}{4}\frac{7}{1}A \\ 24: 305 & 9 & 1\frac{4}{1}B \end{cases}$  paid.

(8) First, 10-7=17; then—
As 17l.: 52l. 10s. :: 10l.: 30l. 17s. 7\frac{3}{4}d. \frac{7}{17} A.'s Gain.

£. £. £. s. d.

And,—If 45: 100:: 30 17 7\frac{3}{4} \frac{1}{17}

Or, 734400: 100:: 30 17  $7\frac{1}{4}$   $\frac{1}{17}$  Or, 734400: 100:: 504000 Seventeenth's. 7344,00)504000,00(£.68 12s.  $6\frac{1}{2}d$ .  $\frac{25}{73}\frac{92}{44}$ A's

Adventure.

Again, — As 17l.: 52l. 10s. :: 7l.: 21l. 12s. 4d. 16 B's

Gain.

Alfo—If 45: 100:: 21 12 4 16 Or, 734400: 100:: 352800

7344,00)352800,00(£.48 os.  $9\frac{1}{4}d.\frac{4552}{7544}$  B's Adventure.

(9) First, 50 Guineas=£.52 10s. B's Gain, which take from £.74 11s. A's Gain, leaves £.22 1s. Difference. £.52 10s. +£.74 11s.=£.127 1s. the whole Gain.

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Alfo

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f. s. f. s. d. f. s.

Then—If 22 1: 19 19 8:: 127 1

Or, 441s.: 4796d.:: 2541s.

441)12186636(27634d. or £.115 2s. 10d.  $\frac{42}{447}$  Cost, which added to the Gain, viz. £.127 1s.= £.242 3s. 10d. or 58126 Pence, which  $\div$  by 55s. viz. 660 Pence, will give 88 Anchors, and 3s. 1.0d. over; then, £.127 1s.  $\div$  88 = £.1 8s.  $10\frac{1}{2}$ d. gained per Anchor.

(10) First, from 14s. 6d. take 8s. 6d. remains 6s. A gains more than B; then,
s. d. { 14 6: 4 4 7 A's } Stock.
As 6: 35:: { 8 6: 2 9 7 B's } Stock.

(11) First, 210+312=522£. Sum of A and B's Stock, and 140-£.37 10s.=£.102 10s. their Gain, then, £. £. s. d. Rem.

£. £. s. £. £. s. d. Rem.

As 522: 102 105. ::  $\begin{cases} 210: 41: 4 : 8\frac{1}{4} : 108 \text{ A's} \\ 312: 61: 5 : 3\frac{1}{4} : 414 \text{ B's} \end{cases}$  Gain.

As 102l. 10s. : 522 :: 37l. 10s. : 190l. 19s. 6d.  $\frac{6}{41}$  C's Stock.

(12) First, 8+5=13£. their Gain per Cent.

Answ. A had for his trouble, 35 10 9 123

AB, AC, BC, AB, AC, BC.

```
.. 118 = 2= 59 B's Share = 269 their Sum.
Alfo, 59+50=109 C's
                                                                                                                                                          d. Rem.
                                                                                                                                          5.
As f.269:30s.:: \begin{cases} 59:6 & 6\frac{3}{4} & 225 \text{ B's} \\ 101:11 & 3 & 180 \text{ A's} \\ 109:12 & 1\frac{3}{4} & \frac{1}{269} \text{ C's} \end{cases} Share of the 30s,
                                                                                           Meal. Malt. Meal. Malt.
               (14) First,—As 3 : 5 :: 8 : 13\frac{1}{3} = \frac{40}{3}
  Then, 8+7+131=281=853, their Sum.
  As \frac{85}{3}: \begin{cases} \frac{40}{3} :: \frac{100}{7} :: \frac{800}{77} = 47\frac{1}{77} = 376\frac{8}{77} = \frac{6400}{77} & \text{Malt.} \\ \frac{8}{7} :: \frac{100}{7} :: \frac{480}{77} = 28\frac{1}{77} = 225\frac{1}{10} = \frac{3840}{77} & \text{Meal.} \\ \frac{7}{7} :: \frac{100}{7} :: \frac{420}{77} = 24\frac{12}{17} = 197\frac{1}{17} = \frac{3300}{17} & \text{Oatmeal.} \end{cases}
                              * \frac{900}{17} = \frac{2}{3} = \frac{1200}{177} \} Price of the \text{Malt.} Meal.
                              429×3= 219
                                                                                                                                                                                             Oatmeal.
                Here the Denominator (17) may be omitted, and the
    Numerators divide by 30, the Quotient will still retain the
    same Proportion.
                             3,0)120,0+48,0+21,0(=40+16+7=63 Sum.
                                                                                                                                                              £. s. d.
      As 63:142:: \begin{cases} 40:\frac{5680}{63}=90 & 3 & 2\frac{2}{21} \text{ Malt.} \\ 16:\frac{227}{63}=36 & 1 & 3\frac{5}{21} \text{ Meal.} \\ 7:\frac{994}{63}=15 & 15 & 6\frac{14}{21} \text{ Oatmeal.} \end{cases}
                                                                                                                                                                                                                                                                                        Coft.
                                                                                                                                                                                s. d.
    Then, \frac{3680}{63} \div \frac{6400}{17} = \frac{9656}{0320} £. = 49\frac{30}{6} Malt.
And, \frac{227}{63} \div \frac{3840}{17} = \frac{38624}{2920} = 32\frac{20}{63} Meal.
Also, \frac{94}{63} \div \frac{370}{17} = \frac{16808}{216600} = 17\frac{10}{63} Oatmeal.
                                                                                                                                                                                                                                                                           pr Bash
                                            (15) First, \frac{12}{11} of \frac{3}{8} = \frac{9}{22}, B's Part.
      And, \frac{4}{13}, \frac{9}{22}, \frac{1}{6} = \frac{528}{1716}, \frac{92}{1716}, \frac{286}{1716}, or \frac{264}{858}, \frac{361}{858}, \frac{143}{858}.
     Then, \frac{35}{858} - \frac{2}{858} = \frac{87}{858} = \frac{23}{858} = 0 Difference betwixt A's and B's. And, \frac{143}{858} + \frac{85}{858} = \frac{23}{858} = 0 C's Part. Alfo, \frac{264}{858} + \frac{35}{858} = \frac{230}{858} = \frac{845}{858} = \frac{45}{858} = \frac{845}{858} = \frac{15}{858} = \frac{15}{858}
        As 858 :: 400 :: 
\begin{cases} £. & £. & s. & d. \\ 264 : 223 & 1 & 6\frac{1}{4} & 726 \text{ A's} \\ 351 : 163 & 12 & 8\frac{1}{2} & 780 \text{ B's} \\ 230 : 107 & 4 & 6\frac{1}{4} & 54 \text{ C's} \\ 31 : & 6 & 1 & 2\frac{1}{2} & 156 \text{ D's} \end{cases}
Share.
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A

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### 23. DOUBLE FELLOWSHIP; or FELLOWSHIP with TIME.

(1) First, 240×4= 960 A's And, 220×6= 720 B's Also, 200×8=1600 C's

Sum 3280 then,

Sum 3200 then, £. £. s. d. £. £.  $960: 76 \text{ i } 11\frac{1}{4} 216 \text{ A's}$ As 3280: 260::  $726: 57 \text{ i } 5\frac{1}{2} 80 \text{ B's}$ 1600: 126: 16 7 32 C's Gain.

(2) 4×4×50= 800 Officers Pay and Time. 8×4×40= 1280 Midshipmens Ditto. 120×3×28=10080 Sailors Ditto.

12160 Sum.

£. s. d.

800: 263 3 13 704 Officers.

1280: 421 1 05 640 Midship

10080: 3315 15 54 1088 Sailors. L. s. d. 

(3) 60×4=240 A's Stock and Time. 40×5=200 B's ditto.
30×3= 90 C's ditto.

530 Sum of their Stocks and Times.

As 10580: 460::  $\begin{cases} 3600 : 156 \text{ 10 } 5 \text{ 920 A's} \\ 4460 : 193 \text{ 18 } 3 \text{ 552 B'e} \\ 2520 : 109 \text{ 11 } 3\frac{1}{2} \text{ } \frac{644}{1058} \text{ C's} \end{cases}$ 

(5) Reciprocally, As 19:84 12 6:: 7:229 13 11 17

 $6 \times 3 + 1 = 19$ 

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7)1607 17 6

Anfw. B's Adventure, £.229 13 1117

(6) First, 20+1.26 5s. +32=1.78 5s. Sum of their Gain. £. s. £. s. d. Rem. £. s. £.  $\begin{cases} 20 \text{ o}: 163 \text{ i}: 6\frac{3}{4} \text{ 225 A's} \\ 26 \text{ 5}: 214 \text{ i}3 \text{ i}: 980 \text{ B's} \\ 32 \text{ o}: 201 \text{ i}4 \text{ 6} \frac{360}{1565} \text{ C's} \end{cases}$  Stock and Time.

Therefore, £. s. d. £. s. d. 163 11  $6\frac{3}{4} \div 9 = 18$  3 6 A's 214 13 11  $\div 7 = 30$  13 5 B's 201 14 6  $\div 5 = 20$  6 10\frac{3}{4} C's

Stock, Fract. rejected.

```
(7) First, 72£. 10s=1450s. C's Stock; then by Sect. 15.
        G.
1450:9:23 Here 23×6=138 Divifor.
-: 6:13 And 1450×9×13=169650 Dividend.
 138)169650(1229s. 4d. 4=61
                                4 A's Stock.
                            9
   Again,-
 S. T. G.
1450 : 9 : 23 Here 23 × 5=115 Divisor.
   -: 5: 18 And, 145×9×18=234900 Dividend.
                          £. s. d.
115)234900(20425. 74d.725=102
                                  7 B's Stock.
                               2
                                  0
                                     A's -
```

(8) Here, suppose X's Gain to be Then by the Question Y's will be 3 =9 their Sum. And Z's - - 4 f. s. d. Pence.

1. S. d. Pence.

1. S. d. Pence.

2. 93 6 8=22400 X's 3: 140 0 0=33600 Y's 4: 186 13 4=44800 Z's Gain.

2. Therefore,  $22400 \times 4 = 89600 X$ 's  $33600 \times 6 = 201600 Y$ 's  $33600 \times 6 = 201600 Y$ 's  $44800 \times 9 = 403200 Z$ 's Gain and Time.

1. Gain and Time.

Answer, the whole Stock, £.236 1 114

Now rejecting the o's, we shall have the following Proportion.

$$\begin{array}{c}
f. & s. & d. \\
896 : 549 & 18 & 8\frac{1}{2} & 448 \text{ X's} \\
2016 : 1237 & 7 & 1 & 4480 \text{ Y's} \\
403^2 : 2474 & 14 & 2\frac{1}{4} & 2016 \text{ Z's}
\end{array}$$
Stock.

(9) First,  $\frac{1}{3} + \frac{2}{3} = \frac{3}{13} + \frac{10}{13} = \frac{13}{13}$ , then  $\frac{13}{13} = \frac{2}{13}$  B's Gain; and rejecting the Denominator, we shall have A's Gain=3, B's2, and C's 10; then

(

(

S. T. G. .

400: 7: 10Here, 10×5= 50 Divisor.

--: 5: 3 And, 400×7×3=8400 Dividend. 5,0)840,0(1681. A's Stock.

S. T. G.

400: 7: 10 Here, 10×8=80 Divisor.

-: 8: 2 And, 7×2×409=5600 Dividend. 8,0)560,c(70l. B's Stock.

(10)

From Feb. 10, to June 10, — = 122

Jan. 17, to April 30, = 61

July 14, to 14 after St. James's=125

Aug. 2, to Nov. 13, — = 104

May 1, to June 24, — = 55

Sept. 30, to Oct. 19, = 20

387 Horse

### 24. BARTER.

(1) First,  $4Cwt = 112 \times 4 = 448lb$ . at 12s.

Then per Case 4, Sect. 16.  $448 \times 6 = 268l$ . 16—

Value of the Tea.—Now,

As 1l. 10s.: 1 Cwt.:: 268l. 16s. Or,

As 30s.: 1:: 5376s.: 179Cwt. 22\frac{2}{5}lb. of Sugar, the Quantity required.

- (2) First, 45 Yds. at 1s. 4d.=3l. or 6os. Then, 60÷18=3<sup>1</sup>/<sub>3</sub> Yds.
- (3) First, 30Cwt.=3360lb. at  $7\frac{1}{2}d$ . per lb. Now, d. d. d s. s.  $\frac{1}{4}\frac{1}{2}\frac{1}{4}\frac{1}{4}\frac{1}{2}\frac{1}{4}\frac{1}{2}\frac{1}{4}\frac{1}{2}\frac{1}{2}\frac{1}{4}\frac{1}{2}\frac$

84 Again,—As 45s.: 1 Cwt.:: 2100s.: 46Cwt. 29rs. 183lb. the Answ.

TO 1 1 2 Lors 12 Chartening

105£.=2100s.

· s. d. s s. d.

(4) If 8 6: 10:: 1 6 Or,

As 17 fix-d.: 10s. :: 3 fix-d.: 1s. 9 3 per lb. the Anf. d. d. f.

(5) Then-If 6:4:: 20 Or,

As 1 fix-d.: 4d.: 800 fix-d.: 3200d.=13l. 6s. 8d. real Value of A's Currants.

Now 201. -2=101. or 200s. and 6s. 8d.=80d. Value of B's Candles.

·. As 7s.: 80:: 200s.: 2285 1d. ==

£. s. d.

9 10 51 freal Value of B's Candles.

o gave in ready Money.

A received 19 10 52 6 13

Answer, f. 6

- A got of B.

(6) Cwt. f. s. . £. s. £ . s. \_\_\_ First 18 at 1 11 per C .= 1 11 × 3 × 6 = 27 18 real Value. And ditto at 2 2-2 2×3×6=37 16 Adv. Value.

.. A advanced his Sugar, 9 18

Also, 3)371. 16s. (=121. 12s. A received in Cash, and

37l. 16s.—12l. 12s.=25l. 4s. in Paper. Again, 15s. 6d.—14s.=1s. 6d. B advanced his Paper.

Therefore,

s. d. d. £. s.

If 15 6: 18:: 25 4 X40 Sixpences in a f. X 2

1008 31 X18

31)18144(585d. or 21. 8s. 94d. 3 B's ad-

vance on his Paper.

Then from 91. 18s. take 21. 8s. 914d. 31. Rem. 71. 9s. 21d. 26 in A's Favour the Answer.

### Barter.

(7) First 5 6-4 5=1 1 Gain per Piece. And 5 6-2 =2 13 required down.

Also, 4 5-2 13=1 12 Value of the Half remaining.

Made £.2 13 of the half remaining.

Her

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No

Dit

16

Fro

£. s. £. s. d.

Then,-If 1 12: 2 13::3 Or.

As 128 three-d.: 53s.:: 1 three-d.: 42d. 1226 per 10. the Answer.

(8) First, 13 0 \ ×50= \ \ \ 650 advanced Val. of the Cloth 575 real Value.

£. 75

s. d. s. d.

Again, 2 6×2=5 o adv. Value of the Wool per Tod.

—4 2 real Value.

o 10 Gain per Tod. or 5d. per Stone.

s. d. St. f. If 2 6:1:: 650 Or,

fix-d. St. fix-d. St.

As 5:1:: 26000: 5200 at 5d. per Stone. Now,

4d.  $\frac{1}{60}$  5200 Stone.  $\frac{1}{4}$  86 13 4 21 13 4

£.108 6 8 gained by the Wool.

A Sack=26 Stone; therefore, 5200-26=200 Sacks, which will pay for the Cloth.

.. 1081. 6s. 8d. -75l. = 33l. 6s. 8d. B's Gain by this Affair.

d. d. s. d.
(9) If 10: 16:: 20 or 240
240
10)3840
12)384

32s. advanced Value of the Malt. 20 real Value.

Here 30 Guineas × 21=630 Shillings, which :by 12=52\frac{1}{2}

Quarters, or 420 Bushels, the Answer.

(10) 720 Ells, at 5s. per Ell, or = 180l. Real Val. of the Ditto 6s. 8d. or = 240 Adv. Holland.

240l. at 10l. per Ct. or = 24 Difcount.

Then 240-24=216l.

And 216 = 2=108paidin ready Money.

L. L. s.

Then - If a 16 : 180 :: 26

Then,—If 216: 180:: 36

Now 1081.=2160s. which: 30=72lb. the Quantity delivered.

s. d. s. d.

(11) If 8 or 96: 10:: 6:  $7^{\frac{1}{2}}$  Bar. Price of the Pamphlets.

100 Reams at 8s.=40l. real. Value of the

Ditto. at 10s.=50l. advanced Paper.

1=50l.  $\div 4$ =12l. 10s. B to have in Cash.

40l. Value of B's Pamphlets.

×40 Sixpences in a £.

1600 Pamphlets to be delivered.

From 401. take 121. 10s. Rem. 271. 10s. what they then stood him in, so that the Advantage to B is 271. 10s.

(12) First, 140lb. 110z.=1691 oz.	1	
55. $\frac{1}{8}$ 1691 at 6s. 4d.   5. $\frac{1}{3}$ 1691 a	t 7s. 2d.	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	13 4 5 6 '	
£. 535 9 8 real Value	18 10	
f. s. d. f. s. d. From 605 18 10 take 535 9 8 Remain whole Advantage of A's Plate. 1/2 f.605 18 10—	s 701. 9s.	2d.
86 11 37 received in read	y Specie.	
£.519 7 $6\frac{6}{7}$		
7C. 2qrs. 18lb.=858lb. at 11s. 2d. 10s. $\frac{1}{2}$ 858 at 11s. 2d. 5s. $\frac{1}{4}$ 858 at	9s. 6d.	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		
479 1 adv. Val. of 407 1  B's Tea.	1 real Va - B's Tea.	
£. s. d. $5^{19}$ 7 $6^{\frac{6}{7}}$	£. s. 519 7	65
-479 1 0 $f$ 40 6 $f$ Difc. allowed	111 16	
A's Advantage by the Rife of his Plate,	70 9	9 2
B's whole Advantage, — —	£.41	7 4 4 7
(13) 14C. 2qrs. 25lb. at 3l. 3s. per Cwt advance Value of A's Hops.	.== 461. 7s	, 6 <del>3</del> d.

Gal

I

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If

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s. s. s. If 59: 63:: 6

59)378(6s. 4\frac{3}{4}d. \frac{3}{5}\frac{1}{5}\$ advanced Price of B's Wine per Gallon. Now 1\frac{1}{2} hhd. = 94\frac{1}{2} gal. at 6s. 4\frac{3}{4}d. \frac{3}{1}\frac{1}{9}

10\times 9 + 4\frac{1}{2} = 94\frac{1}{2}

B's Wine comes to 30 5  $5\frac{1}{4}d_{-5}$ ?
A's Hops 46 7  $6\frac{3}{4}$ 

Answ. £. 16 2 14d.50

### 25. LOSS and GAIN.

 6d.
 240 at 14s. 6d.
 240 at 18s.

 7
 9

 168
 216,0 Sold for.

 6
 174 Cost.

 Cost £. 174 Ans.
 £. 42 Gained.

- (2) First, 9C. 2qrs. 18lb. = 1082lb. and 46l. +12l. 12s. = 58l. 12s. or 1172s. fold for; therefore, 1082)1172(1s.  $0\frac{3}{4}d$ .  $\frac{1074}{1082}$  per lb. the Answer.
- (3) First, 10s. 6d.—8s. 6d.—2s. Gain by 8s. 6d.—then s. d. s. f.

  If 8 6: 2:: 100 or,

  As 17 six-d.: 2s. :: 4000 six-d.: 470s. 7d. 17

  Or, 23l. 10s. 7d. 17 the Answer.
- (4) First, 1001.+8=1081. Amount: then s. £. s. d.

If 5: 108:: 6 3 then 135—100=35l. Answer.

20 25 25 Threepences.

Mr. Webseer's Answer is tol.
2,0)270,0(135l.

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(5) First, 100+7l. 10s.=107l. 10s. Amount.

s. £. s. s. d.

If 5: 107 10:: 5 9 Or,

As 20 three-d-d.: 2150s.:: 23 three-d.: 2472s.=123l.

12s. 6d. Amount per Cent.

Then 123l. 12s. 6d.—100=23l. 12s. 6d. the Answer.

Mr. Stonehouse's Answer is 8l. 12s. 6d.

(6) First, 100+15=115l. Amount; then,
If 11s. 6d.: 115:: 12s. Or,
As 23 six-d.: 115l.:: 24 six-d.: 120l. the Amount
per Cent.
Therefore 120—100=20l. per Cent. Answer.

Mr. HILL makes the Answer 15l. 13s. 01 d. 23.

(7)  $3d. \begin{vmatrix} \frac{1}{4} \\ | 500 \text{ at 1s.} 3d. \text{ Now 100-9=91}l. \text{ or 1820s. then} \\ \frac{152}{625s.=31} \quad \text{f. s.} \quad \text{If 1820: 100:: 625}$ 

Therefore, 34l. 9s.  $6\frac{3}{4}d$ .  $\frac{6}{9}\frac{3}{7}$  Ant. 31l. 5s. =3l. 1s.  $9\frac{3}{4}\frac{3}{9}\frac{3}{7}d$ . the Answer.

Mr. Dilworth's Answer is 2l. 16s. 3d.
(8) First, 100+25=125£. Amount; then,
As 6l. 15s.: 125:: 8l.: 148l. 2s. 11½d. 3 Amount per Cent.
Then 148l. 2s. 11½d. 2—100=48l. 2s. 11½d. 3 the Answer.

Mr. WALKINGHAM'S Answer is 291. 125. 7d. 8

(9) First, 100+30=130l. Amount; then, As 3l. 10s.: 130l.:: 4l. 5s.: 157l. 17s. 1\frac{1}{2}c.\frac{6}{7} Amount per Cent.

Then 157l. 17s.  $1\frac{1}{2}d.\frac{6}{7}$ —100=57l. 17s.  $1\frac{1}{2}d.\frac{6}{7}$  Answer.

(10) First, 100—27=83l. and 100+20=120l. then,  $f \cdot f \cdot f \cdot s \cdot f \cdot s$ . If 83: 100:: 52 10:63 5  $\frac{5}{83}$  $f \cdot f \cdot f \cdot s \cdot f \cdot s \cdot d$ .

Again, As 100: 120:: 83 583: 75 18 03 49 Worth.
Sold for 52 10 0

Answer, £. 23 8 03 49

(11) 112lb. at 25. 11d. 2=16l. 125. 10d. 2 fold for at Turky.

Then 161. 125. 10d. 3 : 2=81. 6s. 5d. 1 coft him.

Therefore, from 81. 6s. 5d.  $\frac{1}{3}$ , take81. Rem 6s. 5d.  $\frac{1}{3}$  Lofs, the Answer.

(12) First, 4s. 3d. +2d. =4s. 5d. prime Cost and Charges.

s. d. s. £. s. d.

Then—As 4 5: 6:: 100: 2716 113 55

Then—As 4 5: 6:: 100: 2716 114 33 Again, 100—12=881.

f, f, s, d.

Also—If 100: 88:: 2716 113 5 7. s. d.

Or, as 5088000: 88:: 6912000: 119 10  $11\frac{1}{4} \frac{15}{53}$  Amt. Then, 119l. 10s.  $11\frac{1}{4}d$ .  $\frac{1}{53}$  100=19l. 10s.  $11\frac{1}{4}d$ .  $\frac{15}{53}$ , gained per lb. the Answer.

(13) First 800×14=11200lb. at 12½d. per lb.

Then 11200×12½=140000d. Value of the Anchovies:

which: by 749,0, gives 18½d. 574/49 Amount of 12½d.

Again, 100+17=117l. Amount; then,

£. £. d.

If 117: 100::  $18\frac{1}{2}\frac{574}{749}$ Or, As 84127680: 100:: 5542900: 15.  $3\frac{3}{4}d$ .  $\frac{2085256}{8}$ , the Answer.

(14) First, 41l. 3s. 4d.=988od. and 3s. 1d.=37d. Then,  $9880 \div 37 = 267 \frac{1}{37}lb$ . at 3s. 1d. per lb. bought.

Again, 341. 2s. 6d.=8190d. and 4s. 6d.=54d.
Then 8100=54=1512lb fold at 4s. 6d. per lb

Then,  $8190 \div 54 = 151\frac{2}{3}lb$ . fold at 4s. 6d. per lb.

Therefore,  $267\frac{1}{37} - 151\frac{2}{3} = 267\frac{3}{17} - 151\frac{49}{15} = 115\frac{49}{15}lb$ .

Spoiled at 3s. 1d = 37d. fo that  $115\frac{49}{15} \times 37 = 4268\frac{37}{15}d$ .

or 17l. 15s.  $8\frac{1}{4}d$ .  $\frac{37}{15}$  prime Cost of the Goods spoiled.

(15) First,  $\frac{3}{8}$  of 11s.= $\frac{3}{8}$ , or 4s.  $1\frac{1}{2}d$ . gained per Thousand, when he fold them at 11s.: 11s.—4s.  $1\frac{1}{2}d$ .=6s.  $10\frac{1}{2}d$ . per Thousand prime Cost; then,

As 6s.  $10\frac{1}{2}d$ .: 11s. :: 100l. : 160l. Amount of 100l.

Again, As 11s.: 160l.:: 13s.6d.: 196l. 7s. 3\frac{1}{4}d. \frac{1}{11} Amount per Cent. at 13s. 6d.

Then, 1961. 7s. 3\(\frac{1}{4}\)d. \(\frac{1}{1}\) = 100=961. 7s. 3\(\frac{1}{4}\)d. \(\frac{1}{1}\) gained per Cent. the Answer.

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Then 500 16 8-32 11 1=468 5 7 Wine cost C. Also, 468 5 7-38 11 6=429 14 1 - cost B.

Then 429l. 14 1—18 12  $4\frac{3}{4}$ =411 1  $8\frac{7}{4}$  cost A. Alfo, 411l. 1s. 8d.=8221s.  $8\frac{3}{4}d$ . and 15 Pipes × 126=1890 Gallons; then 1890)8221s.  $8\frac{1}{2}d$ . (4s. 4d.  $\frac{3}{189}$ , per Gal. the Answer.

(17) First, \$\frac{3}{7}\$ of 480l. 12s.=137l. 6s. 3d. \$\frac{3}{7}\$, Cost of the damaged Goods; then 137l. 6s. 3d. \$\frac{3}{7}\$—48l. 18s.= 88l. 8s. 3d. \$\frac{3}{7}\$ made of the damaged Goods.

\*.\* As 5 6: 1::88 8  $3\frac{3}{4}$ :  $321\frac{234}{422}$  Yards, damaged,  $321\frac{284}{462} \times 7 = 2250\frac{252}{462}$  Yards, which  $\div 2 = 1125\frac{126}{462}$  Yards bought in all.

Then 1125 \frac{126}{462} - 321 \frac{234}{462} = 803 \frac{354}{462}\$ Yards undamaged.

Again,—From 480l. 12s. take 88l. 8s. 3d. \frac{3}{7} Rem. 392l. 3s. 8d. \frac{4}{7} to be made of the undamaged Goods.

.: If  $803\frac{354}{462}$ : 392 3  $8\frac{4}{7}$ :: 1
Or, As  $37\frac{134}{462}$ 0:  $65887\frac{2}{7}$ ::  $\frac{5}{4}$ :  $\frac{1521994320}{150396703}$  =125.  $2\frac{7}{4}d$ .  $\frac{1475775}{1599177}$  per Ell.

### 26. ALLIGATION MEDIAL.

Gal. at s. s.  $\times$  8=112  $\times$  6= 72  $\times$  7= 70  $\times$  4= 80  $\times$  9= 72

As 64 : 406 :: 1 Gal. : 6s. 4 d. the Answer.

Gal. at d. f. f. d. d. (2)  $13 \times 80 = 1040$  If  $100: 110: 2600: 11 10\frac{3}{4}$  or 2860  $20 \times 60 = 1200$  then 2860—2600=260. Also 2600  $10 \times 36 = 360$  +260 = 2860. -qrs. As  $172: 2860: 1: 16\frac{1}{4}d_{\frac{3}{4}\frac{3}{4}\frac{3}{4}}$ , Sum 43 = 172, 2600 the Answer.

# 27. ALLIGATION ALTERNATE.

As Examples of this Nature will admit of as many different Answers as there are different Ways of linking together a larger Price and a less than the middle or mean Rate proposed, so consequently the last will admit of seven different Ways or Answers.

of the summation of the value

28. ALLIGATION PARTIAL.

(5) d. Diff. Diff. lb. S. d.

$$\begin{cases}
144 \\ 108 \\ 90 \\ 78
\end{cases}
\begin{cases}
18 \\ 12
\end{cases}
Diff. lb. \begin{cases}
18 : 108 \\ 48 : 288 \\ 12 : 72
\end{cases}$$
of 
$$\begin{cases}
9 & 0 \\ 7 & 6 \\ 8 & 6
\end{cases}$$
(6) d. Diff. lb. Diff. lb. Diff. lb.

d. 
$$\begin{cases}
30 \\ 20 \\ 18
\end{cases}
\end{cases}$$

$$\begin{cases}
4+6+9=19 \text{ If } 10:120::6:37\frac{17}{19}, \text{ fo that with } 120lb. \text{ of the given } 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{cases}$$
Qantity, there must be 37 if it is in the properties of the other, the Answer. In all  $233\frac{1}{17}$  lb.

(2)

or,

Or

45.

6d.

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## 29. ALLIGATION TOTAL.

Sum 12 the whole Quef. 60 oz.

(8) s. Diff. 1 Diff. lb. s. 
$$\begin{cases} 5 \\ 6 \\ 8 \\ 9 \end{cases}$$
  $\begin{cases} 1 \\ 2 \\ As 6 \end{cases}$  Sum oz.  $\begin{cases} 1 : 28 \\ 2 : 56 \\ 2 : 56 \\ 1 : 28 \end{cases}$  at  $\begin{cases} 5 \\ 6 \\ 8 \\ 9 \end{cases}$  Per lb. the Anfwer.

to the second of the second of

Take to the state of the state

(1) Cr. d. Crs. d.

As 1:56::500:28000=1161.13s.4d. the Answer. Or by Practice, thus 4s.  $\frac{1}{5}$ 500 at 4s. 8d.

(2)  $\frac{d}{A}$  Cr. As 56:1:: 116l. 13s. 4d.=28000  $56 \begin{cases} 7)28000 \\ 8) 4000 \end{cases}$ Answer, 500 Crowns.

d. Cro. f. s. d. (4) If  $54\frac{1}{2}$ : 1:: 145 7  $7\frac{1}{2}$   $\frac{1}{9}\frac{1}{0}$ or, as 9810: 1:: 6280471: 640 Cro. 12 sol. 8 din. the An.

## 2. With SPAIN.

d. Piece. £. s. d.

(5) If 56: 1:: 856 6 8

or, as 65: 1:: 205520: 3670 Pieces, Answer.

P. d. Piece. re. mar.

(6) If 1: 54\frac{1}{4}:: 1426 4 26

or, as 272: 217:: 84203378: 309571 \frac{66}{272}\pirs. or \$12l. 9s. 4\frac{1}{4}d. \frac{66}{272}, the Answer.

By Practice, thus,  
45. 
$$\begin{vmatrix} \frac{1}{5} \end{vmatrix}$$
 1426 at 45.  $6\frac{1}{4}d$ .—then for 4  $R$ . 26 Mar. thus,  
4d.  $\begin{vmatrix} \frac{1}{5} \end{vmatrix}$  285 4 0 4  $R$ .  $\begin{vmatrix} \frac{1}{2} \end{vmatrix}$  4  $6\frac{1}{4}$   
2d.  $\begin{vmatrix} \frac{1}{2} \end{vmatrix}$  23 15 4  
1 17 8 17  $M$ .— $\begin{vmatrix} \frac{1}{2} \end{vmatrix}$  3  $\frac{1}{4}$   $\frac{1}{2}$   
0 2  $8\frac{1}{4}$  1 17 8 17  $\frac{1}{2}$  1  $\frac{1}{2}$ 

# 3. With ITALY.

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7) 
$$4s. \frac{7}{5} \frac{640 \text{ at } 4s. 4d. \text{ per Dollar.}}{128} \frac{128}{1013} \frac{13}{4}$$
Aniwer, £.138 13 4

(8) First, 1381. 13s. 4d.=33280 Pence. Then, as 52d.: 1 Dol.:: 33280: 640 Dollars, the Answer.

(9) 2s. 
$$\frac{1}{10}$$
 8644 at 3s.  $11\frac{1}{2}d$  per Pez.  
1 864 8 6d.  $\frac{1}{2}$  432 4 216 2 44 1 4 1 4 54 0 6 2s. 6d.  $\frac{1}{3}$  54 0 6 3  $\frac{1}{4}$  54 0 6 Anfwer, £.1710 16  $3\frac{3}{4}$   $\frac{6}{8}$ 

(10) First, 1710l. 16s. 4d.=821192 Halfpence, and 47½d. =95 ditto. Then—If 95: 1 Pez.:: 821192 h.: 8644 Pez. Answer.

Answer, €. 1269 6 8

(12) First 1566l. 6s. 8d.=375920d. Then-If 64d.: 1 Mil.:: 375920d.: 5873 Mil. 750 Rees.

the Answer.

5. With HOLLAND, FLANDERS, and GERMANY. (13) First, 564l. 10s. 6d.=135486. Pence, and 34s. 4d. =412d.

Then, as 412d. : 11 .:: 135486. 3281. 16s. 113d. 222 the Answer.

f. f. s. f. s. d. (14) If 1: 34 4:: 328 16 11 $\frac{3}{4}$  Or, as 960 qrs.: 412d.:: 315695qrs.: 13548 $\frac{3}{4}$ d.  $\frac{1}{12}$ , or 564l. 10s.5 $\frac{3}{4}$ d.  $\frac{1}{2}$ , the answer.

By Practice thus,

10s. 
$$\frac{1}{2}$$
 328 at 1l. 14s. 4d.

10s.  $\frac{1}{2}$  34 4

4 4d.  $\frac{1}{2}$  164 0
65 12
5 9 4
1 9 1  $\frac{1}{4}$  3  $\frac{1}{2}$  0 10  $\frac{1}{4}$ 

Amswer, £.564 10 5  $\frac{1}{4}$  2  $\frac{1}{3}$  0 5
 $\frac{1}{4}$  0 3  $\frac{1}{4}$  0 1  $\frac{1}{4}$ 

399) 168025 (4211. 25. 31d.27 Answer.

f. s. d. f. s. d. (16) If i: 33 3:: 421 2 3 or, as 240d.: 399d:: 101067d. ×399

24,0)4032 5733(1680234.

213d. 8

24,0)1704(724 Pen.
Now 168023:40=4200 Guil. 11 Stiv. 15246 Pen. the

Answer.

(17) First, 2421. 135. 6d.=58242 Pence; then
4,0)5824,2(1456 Guil. 1 Stiv. the Answer.

6. To Change CURRENT MONEY into BANCO.

G. L. G. St

(18) If 105: 100:: 495 18

20 20 G. St. Pin.
21,00 )9918,00(472 5 1127 Answer.

Rem. 6

20

21) 120(5 Stivers.

Rem. 15d.

X16

21)240(11-9 Pin.

9

A

0

8

G. G. St. G. St.

(19) If 
$$100: 105 12\frac{1}{2}:: 470 8$$

20

20

20

2112

9403

2

4225

9408

2,000)39748,800

2)19874— $3\frac{1}{5}$  St.

20)993,2

Answ. Guild. 496 12 3 1

7. With V E N I C E. Du. fol. den.

(20) If 1: 47\frac{6}{8}:: 4720 10 8

Or, as 240: 382:: 1128128: 224450 $\frac{1}{4}d$ .  $\frac{1}{8}$ , or 935l. 4s.  $2\frac{1}{4}d$ .  $\frac{1}{8}$ , the Answer.

Or by Practice thus,-4700 at 47 %; then for 10 Sol. 8 Den at St. 1 1d. X47 220900 3 1 2 2350 1175 4 253 1 4d. 12)22445043 2,0)18704-2 252

Anf. £. 935 4 2 43

8. With POLAND and PRUSSIA.
G.P. f. Flor.

(21) If 270 1: 4684

Or, as 270: 1:: 140520: 520l. 8s. 10d. 3 Flemish.

(

0

Or

Or

Again, If 34s. 4d. : 11. :: 5201. 8s 10d. 3. Or, as 1256 Thirds : 1 :: 374720 Thirds : 3031. 35. 5d. 24 the Answer.

d. s. d. Now 270 Gros. = 9 Florins;  $4 \begin{vmatrix} \frac{1}{3} \\ \frac{3}{3} \end{vmatrix}$  390 at 33 4 Then—If 1l.: 9 Fl.:: 650l.:d. (22) 5850 Florins the Answer. X33

12870 130

2,0)13000

650f. Flemish.

With R U S S I A-Rub. cop.

(23) 6420 42 X100

122)642042(5262778 Rix dellars. X2 1

 $\frac{105257\frac{34}{22}}{26317\frac{39}{22}}$  Floring Current. Fl.Cur. Fl.B.

If 103: 100:: 1315673 Flor. Banco. Or, as 12566: 100:: 1605105: 12773 6283.

Now 12773  $\frac{2401}{6283} \times 40 = 510935 \frac{539}{6283}$  Pence, and 34s. 6d.=

Then—If 414d.: 11.:: 510935 6283d.

Or, as 2601162: 11. :: 3210210000: 12341. 25. 1024. 2687964, the Answer.

#### With IRELAND. 10.

L. s. d. f. f. (24) If 112: 100:: 740 14 6 Or, as 4880 fix-d: 100:: 29629 fix-d:: 6611-75. 23d. 748 the Answer.

Answer, £.729 19 13

11. With AMERICA and the WEST INDIES.

(26) If 164: 100:: 1474 16

Or, as 3280s.: 100:: 29496s. £.899 5s.  $4\frac{1}{4}d.\frac{184}{328}$ , the Sterling required.

Answer, £.1547 18 11 Currency.

(28) First, 100+30+5=135 Amount. Then—If 135l.: 100l.:: 987l. 12s.

Or, as 2700s. : 100 :: 19752s. : 731l. 11s.  $1\frac{1}{4}d$ .  $\frac{1}{2}$  remitted.

Configned - 640 16 9

Gained - £. 90 14 41 2 Sterling.

f. s. d. f. s. d. f.

Therefore—If 640 16 9: 90 14 4\frac{1}{3}:: 100

Or, as 153801d.: 261268 Thirds:: 24000d.: 14l. 3s. 1\frac{1}{4}d.\frac{2}{3}

gained per Cent.

(29) 25  $\frac{1}{4}$  1470 12 8 at 136 $\frac{1}{2}$  per 100 367 13 2 147 1 3 $\frac{1}{10}$  14 14 1 $\frac{1}{2}$  7 7 0 $\frac{3}{5}$  2 2007 8 3 $\frac{1}{5}$ 

R

s. d. L. d. (30) If 34 4:1::52 Or, as 412d: 240d.::52d.:30d. $\frac{30}{100}$  for 400 Reas.  $30\frac{30}{100} \times 2\frac{1}{2} = 75\frac{705}{100}$  Pence Sterling for 1000 Reas.

Crown.

(31) 45 | 1 | 1 | 200 at 45. 7d. per Crown.

6d. | 3 | 240 | 30 | 5 |

£. 275 0 0

If 100: 10:: 275: 275. 6d. Commission.

Therefore 275l.+1l. 7s. 6d.=276l. 7s. 6d.=66330d.

Then, as 56d.: 1Cr.:: 66330d.: 11.84\frac{1}{2}\frac{3}{8}Cr.

.: 1200-1184\frac{1}{2}\frac{3}{8}=15\frac{1}{2}\frac{5}{8}\text{ A's Gain.}

d. Sols. d. Sols.

(32) As 67: 32:: 70: 3320 Lubeck, per Florin.

(33) Receip.—If  $54d.: 33s. 6d.:: 54\frac{7}{2}d.$ Or, as 108: 142:: 109:  $398\frac{3}{109}d.=33s. 2d.\frac{3}{109}$  Flemish, the Answer.

(34) If 100: 102:: 33 4. £. £. s. d.

Or, as 6000: 102:: 100: 11. 14s. Flem. per f. Sterling.

(35) If  $100\frac{3}{20}$ : 100:: 91:  $90\frac{1730}{2003} = 90\frac{629739}{602903}$ . Also,  $100\frac{1}{3}$ : 100:: 93:  $92\frac{416029}{602903}$ .

Then  $92\frac{4}{6}\frac{1}{6}\frac{6}{2}\frac{2}{9}\frac{4}{6}\frac{3}{3}$   $90\frac{5}{6}\frac{29}{2}\frac{9}{9}\frac{3}{3}\frac{9}{3}$   $= 1\frac{3}{6}\frac{3}{2}\frac{3}{9}\frac{67}{3}$ , Gain per Cent. for two Months; therefore  $1\frac{4}{6}\frac{3}{2}\frac{9}{9}\frac{57}{3}\times 6 = 10^{\frac{12}{6}\frac{8}{2}\frac{5}{9}\frac{3}{9}\frac{3}{3}} = 10$ .

(36) First, 2000 × 40=80000 Flemish Pence. Or, 160000 Halfpence, 90½d.=182 Ditto, and 89½d.=

181)160000(883<sup>177</sup>/<sub>181</sub> Crowns. 179)160000(893<sup>153</sup>/<sub>1</sub> Tournois.

r, 104: 100::  $883\frac{177}{181}$ :  $849\frac{2303}{2353}$ =  $849\frac{8656977}{8844927}$ .

(1)

All

Th

(2) First

(3)

(4)

(5)

(6)

Also, 105: 100::  $893\frac{153}{179}: 851\frac{1091}{3759} = 851\frac{2557123}{8844927}$ .  $851\frac{2567123}{8844527} = 849\frac{8656977}{8844927}1 = \frac{2550833}{8844927} = 1 Cro. 18 Sols.$  odin. in Favour of B.

31. COMPARISON of WEIGHTS and MEASURES.

Left Hand. Right Hand.

(1) First, 100 100 100 60 113, Now, 100×100×60=600000 81, And, 113×81=9153

Then, 600000 ÷ 9153=65lb. 87656, Answer.

(2) lb. lb.
First, 104  $84\frac{1}{2}$  Then  $104 \times 100 \times 64 = 665600$ 100 108 And  $108 \times 84\frac{1}{2} = 9126$  64 = - 9126)665600(72lb.  $14\frac{3684}{9125}0z$ . the Anf.

(3) 100 78 Then 100 × 78 × 100=7800,00 78 133\frac{1}{3} And 133\frac{1}{3} × 78==104,00 100 Alfo, 104)7800(75 Yards, the Answer. Canes. Ells.

- (4) 100 191 $\frac{1}{3}$  Then  $78 \times 100 \times 100 = 780000$ 78 131 $\frac{2}{3}$  And 191 $\frac{1}{3} \times 131\frac{2}{3} = \frac{226}{9}730$ 100 Alfo  $780000 \div \frac{226}{9}730 = \frac{76200000}{226730} = 30\frac{4}{5}$ Canes, nearly the Answer.

  1b. 1b.
- (5) 100 92 Then 92×110×60=607200 100 110 And 100×100=10000 60
  Alfo, 1,0000)60,7200(60\frac{18}{25}lb. the Answer. Yds. Bra.
- (6) 74 100 Then 100×100×30=300000 100 30 And 74×100=7400 100 Alfo 74,00)300000(4037 Canes the Anfw.

32. SINGLE POSITION.

(1) Suppose A's Age to be 20

Then B's will be 20+10=30

And C's will be 30 × 2=60

Sum 110

As

Al

Ar

(5)

An

(6)

(7)

Or

Sum 132 Proof.

(2) Suppose she had 10 Then 40—10=30
Then as many 10 As 25: 10:: 30: 12 her Flock
One half as many 5 the Answer.

Sum, 25, for 12+12+6+10=40 Proof.

(3) Suppose C's Age to be 10 Then 4+4+9=17

A's 10+4 = 14 And 45-17=28

And B's 30+14+9=33

Sum 57-17=40

As, 40: 10:: 28: 7 C's Age.
7 C's Age.
And 7+4=11 A's.
Also 7+11+9=27 B's.
7 C's.
Proof, 45 D's.

Suppose Andrew goes

Then Ben. will go  $30\times3+3=93$ And Christopher  $98\times2+16=202$ Sum, 325Then  $3\times2+3+16=25$ 

M. M. M. Miles. 300 Diff. As,  $300:30:444:4\frac{2}{3}$  Andrew. Also  $44\frac{2}{5} \times 3 + 3 = 136\frac{1}{5}$  Benjamin. And  $136\frac{1}{5} \times 2 + 16 = 288\frac{2}{5}$  D. Christopher,

# Proof, 469

Now 2000+65=2065, and 65+1735=1800 £. £. £. £. s. Then—As 1800: 200: 2065: 229 8 $\frac{8}{9}$ A. ∴ 229  $\frac{8\frac{8}{9} \times 3\frac{1}{2} - 45 = 15}{8\frac{1}{9} \times 3\frac{1}{9} + 26}$  10=1013 5 C.

Proof, 2000 0

(6) Suppose they will empty the Cistern in 30 Minutes, then the first will empty \( \frac{1}{2} \) or 30 Pipes.

The second

And the third

Tor 15

Sum, 55

Gal. Min. G. M. Sec. . As 55: 30:: 60: 32 4371, the Time fought.

(7) First,  $\frac{3}{4}$  of  $\frac{1}{2} = \frac{3}{8}$ Suppose he had 240, then  $240 \div 8 \times 3 = 90$ As 90: 240:: 900: 2400 Men, the Answer.

Or, thus,  $900 \div \frac{3}{8} = \frac{7200}{3} = 2400$  Men, as before.

R3

(8)	Suppose he had 12 Then as many 12 ½ as many 6 ½ Ditto 4 ¼ Ditto 3	If 37: 12::333 333 37)3996(108 Scholars, the fwer.	An-
	Sum 37		

P (2)

A

## 33. DOUBLE POSITION.

(1	) A distant			· ···£
Suppose the	Value of the	firf	Horfe to b	
To which a	dd the Value	of	the Saddle	50

To which add the Value of the Saddle	50
	2)70 Double the Val.  — of the Second.
Then the Value of the Second is	35
To which add the Value of the Saddle	50
The Sum should have been triple the Value of the first Horse.	
A . C C.I COIL C. I	, £.
Again, Suppose the first Horse to be work	th 24
Then proceeding as above	50
the cape and the second second the second	2)74
A15- 11- 17-1 1-1-	
Also the Value of the second is	37

Also the Value of the second is	37
01:10	5011
fig. tamp	87=15 too much,

Then 25—15=10 Difference of Errors.

Also 600—300=300 the Difference of the Prod.

300 :.300:10=30 the Value of the first Horse.

£.30 Value of the first Horse. 50 Value of the Saddle.

2)80 Double the Value of the fecond Horfe.

f. Brought over. 40 Value of the second Horse. 50 Value of the Saddle.

```
Proof, 90=30×3=90
                                              d.
(2)
     Suppose he had 8 | Again, suppose he had
     Then 8+ 8=16
                           Then
                                      7+7=14
     Alfo, 16-6=10
                                     14-6= 8
                                      8+8=16
         10+10=20
          20- 6=14
                                     16-6=:0
          14+14=18
                                     10+10=20
          28 - 6 = 22
                                     20- 6=14
           too much.
                                       too much.
    Sup.
         Er.
          22 | Then 22-14=8, and 154-112=42
          14 :.42 \div 8 = 5\frac{1}{4}d. the Answer.
 (3)
              Crs.
              28 A's Again, suppose A had
44 B's Then B 44+
Suppose
Then 28+16: =44 B's
                                 B 44+16=50
                                  C 84+ 6=14
And 28+44+6=12C's
         Sum, 84=28
                                    Sum, 98=14
 too little
                   too little.
    Erianin Gora ai A
   × 28 | Then 952-392=560, and 28-14=14 Diff.
28
      14 of Errors.
34
     -- | .: 14)560( -- 40 A's } Crowns.
952
     -- Alfo 40+56(96) -6=16 C's
(4) Suppose he had 60
                       Again, suppose he had 76
 Tom took 30-10=20
                             Then, 38-10=28
                             Rem. 48
 to at aM
          Rem. 40
 Ned took
           20-4=16
                                    24-4=20
             Rem. 24
                                      Rem. 28
 Jack took
           12-1=11
                                    14-1=13
           Rem.
                                     Rem. 15=3
   too little.
                          too little.
```

Suf

30

So Th

14 42 29

Su 14

	Double 1 ostelon.			
Sup. Er. $\frac{60}{76} \times \frac{5}{3}$ $\frac{180}{3}$	Then 380—180=200, and 5—3=2 200 ÷ 2=100, what he had at first			
(5) -	Suppose the Father's Age to be 40 Then the Son will be $40 \div 5 = 8$ And 4 Years ago was $8-4=4$ which is 12 too little.			
Sub Fr	Again, suppose the Father was 60 Son will be $60 \div 5 = 12$ And 4 Years since was 12—4= 8, which is 4 too little.			
Sup. Er.  40 × 12   Then 720-160=560, and 12-4=8560 60 × 4   ÷8=70 Years, the Father's Age; and 70				
Then $24 \div 2 + 9 = 21$ Tail; also $21 + 9 = 30$ , which is 6 too much.  Again, suppose the Body to be 26, then $26 \div 2 + 9 = 22$ Tail; also $22 + 9 = 31$ , which is 5 too much.  Sup. Er.				
24 × 6 Then 156—120=36, and 6—5=136 Inches is the length of the Body.  And 36 ÷2+9=27 Tail.  Therefore 36+27+9=72 Inches, the Anfw.				
(7) Suppose the No. to be 4 Then $4+4=$ - 8 And $8\times 4=$ - 32 Also $32-4=$ - 28 Likewise $28\div 4=$ 7 Therefore $13-7=$ 6 too little.  Again, suppose the No. to be 5 Then $5+5=$ - 10 And $10\times 5=$ - 50 Also $50-5=$ - 45 Likewise $28\div 4=$ 7 too little.				

#### Brought over.

```
Sup. Er.
 4×6
       Then 30-16=14, and 6-4=2.
       :.14 = 2=7, the Number fought.
       7+7×7-7=91, which:7=13, the Proof.
   16
30
     (8)
Suppose the
                     Again, suppose she
                                          16
              14
Then he 14×3=42
                     Then he will be 16×3=48
14+10-5=
                     16+10+5=
              29
42+10+5=
                     48+10+5=
              57
                                             S fub.
29 X 2
              58
                     31× 2
 too little by
                           too much by
```

Sup. Er.

14 1 Then 16+14=30, and 1+1=2

16 1 : 30 ÷ 2=15 Years, her Age.

- And 15×3=45 his, Answer. For

15+10+5=30 her, when married 15 Years.

And 45+10+5=60 his,

For as 8: 16::30:60 Proof.

(9)	Beg.	Beg. Beg. Beg.
Sup. 8	8	Again, suppose to 10
×4	×6	Beg. Beg. Beg. Again, suppose 10 10 X4 X6
32	48	40 60
+16	48 —12	× 16 -12
. =	_	
48-	36 =	56 —48=8 too
12 too little—	_	— — little.

Sup. Er.  $\frac{8}{10} \times \frac{12}{10}$  Then 120—64=56, and 12—8=4 ...56÷4= 14, the Number of beggars. For 14×4+16 = 14×6—12=72d. what he gave, Proof.

190	Douot	e Position.	
Ţ	Number to be 18 hen $15 \times 3 = 48$ and $45 - 5 = 49$ also $40 \div 2 = 20$ $20 + 15 = 3$ $40 - 35 = 3$	Then And Alfo	25 × 3=75 75 — 5=70 70 ÷ 2=35 35+25=60 60-40=20
Sup. Er.  15 × 5  25 20  125 300	Then 125+300 425÷25=17 For 17×3-5=	, the Number r	equired.
Suppose B h Then A mu For 6—1= Again 4—1 And · 6+1 Also, 3×2 7—6 Sup. Er. 6+1 8 1	It have 4  4+1=5 =3 =7 =6 =1 too lit.  hen 8+6=14, 6 Guineas, and 8	A's; for 7—	1 = 7 = 5 = 9 = 10 much. 14 $\div$ 2=7 B's 1=5+1=6 A's
8 6		ceived 1 of B., when he had 10	
Then 12+ And 14× Also, 42-	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Then $45-5$ And $40 \div 8$ $\therefore 5 \times 3 = 15$	Son's Age. $= 5$ = 5 = 5 = 44

```
Sup. Er.
37 X 2
        Then 90-37,=53, and 2-1=1
        :. 53 is the Father's Age; then 53-5=48, and
    I
45
           48 \div 8 = 6 = \frac{1}{3} of the Son's Age. ...6 \times 3 =
           18, the Son's Age.
90
   37
   (13)
                           f.
                           366
       Suppose B had
        Then 300+3×2 = 240
        And 1200-240 = 960 A's
        Then 960+4×3 = 720
        And 360+720 = 1080 A's and B's.
        :. 1200-1080 = 120 too little.
        Again, suppose B had
        Then 420-3 × 2
                           = 280
        And 1200-280
                           = 920 A's
        Then 920 -4 × 3
                           = 690
        And 420+690
                           =1110
                               go too little.
        ... 1200-1110
Sup.
       Er.
 360 X
            Then 50400-33400=18000
       120
            And 120-90=30 .. 18000
 420
        90
            ÷30=600f. B's Money; and
            600-3×2=400. Also 1200-100=800.
50400 32400
                   As Money, the Answer.
For 600 +800 +4×3=800+600+3×2=1200, the Proof.
       greater. leffer.
                                            leff.
                                       gr.
 (14)
 Suppose 28 and 22
                         Again, suppose 42 and8
  28÷7=4Alfo22×3=66
                          42:7=6; also 8×3=24,
 4+66=70, then 70-
                          6+24=30 .. 50-30=
                             20 too little.
  50=20 too much.
 Sup. Er.
           Then 840+560=1400, and 20+20=40 ...
     20
42×
               1400 -40=35, the greater Number; and
      20
               50-35=15 the leffer; for 35 -7-15×3
840
     560
               =50, the Proof.
```

```
(15) Suppose he worked 140 Days, : 390-140=150
    Days he was idle.
    Then 140×12=1680 And 250× 8=2000 Subt.=320 too little.
Again, suppose he worked 150 Days, :: 390-150=240
    Days idle.
    Then 150×12=1800 And 240× 8=1920 Subt.=120 too little.
  Sup.
          Er.
          320|Then 48000-16800=31200
  140
150
           120 And 120-120=200:31200:200=156
                   Days worked, and 390 - 156=234
       16800
                   Days idle, the Answer.
             - For 156 × 12=234 × 8=1872 Proof.
       (16)
Suppose his Age was
                           24 Suppose he was
                                                      30
Then 24 +3 ×2×4
                        = 64 Then 30 \div 3 \times 2 \times 4 = 80
                     = 126 \text{ And } 80 + 15 + 50 = 145
= 26 \text{ Then } 145 - 100 = 45
= 76 \text{ And } 100 - 30 = 70
And 64+12+50
Then 126-100
And 100-24
..76-26=50 too little.
                              1...70—45=25 too little.
  Sur.
           Er.
  24 × 50 Then 1500-600=900, and 50-25=25:
               900 - 25=36 Years, his Age required.
       For 36 \div 3 \times 2 \times 4 + 18 + 50 - 100 = 164 - 100
                =64 Proof.
1500
      600
(17)
    Suppose the first Horse to be worth
    Then the Trappings must be 50-24 =26
    And the fecond Horse must be 24+26=50
Now 50+26=76, and 24×2=48; also 76-48=28, too
    little.
Again, suppose the first Horse to be worth
                                               28
    Then the Trappings must be 50-28
    And the second Horse must be 28+22
Now 50+22=72, and 28×2=56; also, 72-56=16,
    too little.
```

78

Ho.

S

50

60

4500

(1) T

(2) (3)

O . F		4 m 2 m 1	cos la fai	
Sup. Er.	mL 0 -			
24× 28	1 nen 704	-384=400		37.1
28 16	And 28-	16=13 400	12=33家人	Value
		first Horse; an	na 50—1333=	=103£.
784 384		of the Trappin		
= -	Allo, 333	$+16\frac{2}{3} = 50$ £. V	alue of the	lecond
Horie, for	50+10==	$33\frac{1}{3} \times 2 = 66\frac{2}{3}$ th	he Proof.	
(18)			£.	
	Suppose h	e left	5000	
*	Interest fo	or 11 Years :	=2750	
		Amount		
	Education	, &c. 100 X 11:		
	Liqueactor	기업하게 하고 있는 사람들은 사람들이 없다.		Janes .
			t 6650	
	7400-	-6650=750 too		
		And the second	· £·	4 (1)
		ppose he left	6000	
	Interest in	or 11 Years	2300	40.1
		Amount	9300	
	Education	, &c. 100×11:	=1100	
			8200	
	8200-	-7400=800 too		
Sup.	Er.	7450-000		
5000	7591	Then, 4500000	+4000000-8	Stonoon
6000 X	800		800=15508	
Si et ji	Mari Mari	-1550-	5483£. 175. 5d	_2 -
4500000	4000000	the Apfive	r required.	. 31 .

## 34. ARITHMETICAL PROGRESSION.

- (1) First, 1+24=25 Sum of the Extremes.

  Then per Rule I. 25×24÷2=300 Strokes, the Answer; or per Rule IId. 25×12=300.
- (2) Thus, 1+12×6=13×6=78 Strokes, the Answer.
- (3) First 2+188=190 Sum of the Extremes.
  And 94:2=47=half the Number of Terms.

  Product 8930 Feet 2 Mile=5280 Feet.
  Then 5280)8930(1 Mile, 5 Fur. 21 P. 3½ Feet, the Answer.

(4) First 2+200 =202 Sum of the Extremes.
And 100:2= X50 half the Number of Terms.
A Mile=yds.1760)10100(5m. 5 fur. 36p. 2yds. the
Aniwer.

(5) First 9(. 195.) = 199 Shillings.
Then 1+199 = 200 Sum of the Extremes.
And 100 ÷ 2 × 50 half the Number of Terms.

2,3)1000,0(500 £. the Answer.

(6) Here 43—5=38 Difference of the Extremes.

And 20—1=19 Number of Terms, less one.

Then 38:19=2 common Difference.

Which added to the Age of the youngest, and so on to the rest, will give their several Ages, viz. 5+2=7 Age of the Second.

And 7+2=9 Age of the third, and so on for the rest.

(7) First 60-6=54 Difference of the Extremes.

Then 19-1=18 Number of Terms, less one.

Then 54:18= 3 the common Difference sought.

Then 3 added to 6 and every other Term respectively, gives each Day's Journey as follows, 6+9+12+15+18+21+24+27+30+33+36+39+42+45+48+51+54+57+60=627 Miles from London.

(8) First 50-5=45 Difference of the Extremes.

Then 10-1=9 Number of Terms, less one.

Then 45 ÷9=5 common Difference.

Then each Payment and the whole Debt will be as follow, viz. 5+10+15+20+25+30+35+40+45+50 =2756. the whole Debt.

(9) First 43-5=38 Difference of the Extremes. Then 38-2=19 Number of Terms, less onc.

: 19+1=20 Children he had.

(10) First 60-6=54 Difference of the Etremes.

And 54:3=18:18+1=19 Days, the Answer:

(11) First 19—1=18 Number of Terms, less one.
Then 18×3 (the common Diff.=54.
And 60—54=6, the first Day's Journey.

(12) First 10-1=9 Number of Terms, less one. And 9×2=18. Then 23-18=5, the Answer.

(13) First, 275 ÷ 10 = 27£. 103. And 10—1=9. also 9×5=45, which ÷ 2=22£. 103. Then from 27£ 103. take 22£. 103, Remains 5£. Q. E. F. 6+: Sum A: 9:: 3=: Leag (16)

(1

A

Like

960s (1

198-

adde (1 4×2

ıft.

41

Day the I whice

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2, g

(5

(14) First 100 == 2= 50 what each travelled.

And  $50 \div 5 = 10$ . Alto 5-1=4. Then  $4 \times 2 = 8$ . Likewife  $8 \div 2 = 4 \cdot \cdot \cdot 10 - 4 = 6$  his first Day's Journey, and 6+2=8 the 2d 10 the 3d. 12 the 4th, and 14 the 5th.

Sum of which = 50.

Again, 4)50(12½. Also 4—1=3. Then  $3\times3=9$ . And  $9\div2=4\frac{1}{2}$ : 12½— $4\frac{1}{2}=8$  his first Day's Journey, and 8+3=11 his 2d. 14 his 3d. and 17 his 4th. Sum of which=50 Leagues.

(15) First, 19×3=57. And 57-3=54. Then 54+

6=60, the last Trm required.

(16) First 100×2=200. Then 200-2=198. And 198+1=199 the last Term required.

(17) First 30×2=60. Also 60-2=58.

Again 58+6=64. And 64×30=1920. : 1920-2= 960s.=48£. due, Answer.

(18) First 200×2÷8=50. And 50—12=38. Also 8—1=7. Then 38÷7=5<sup>2</sup>/<sub>7</sub> Miles, the common Diff. required. : 5<sup>3</sup>/<sub>7</sub> added to 6, and every other Term respectively gives for

the ist. 2d. 3d. 4th. 5th. 6th. 7th. and 8th.
6. 113. 164 227. 276. 337. 364. and 44, which,

added together, gives 200 Miles, Proof.

(19) First 200×2=400 and 400÷9=44\frac{4}{9}, also, 44\frac{4}{9}-4×2 (8) =36\frac{4}{9} \cdots 36\frac{4}{9} \cdots 8=4\frac{4}{9} \cdots common Difference.

Then the Miles he travelled each Day will be as follow, viz. 1st. 2d. 3d. 4th. 5th. 6th. 7th. 8th. 9th.

4 85, 136, 176, 222, 267, 313, 358, and 4.4, which

added together = 200, the whole Distance, Proof.

(20) First  $9 \times 2 = 18$  Leagues, double the Space gone each Day by the pursued, which + to the common Difference of the Pursuer's Day's Journey, viz. 2 = 20 the Sum from which take double the Space gone the first Day by the Pursuer, viz. 6 = 14 remains, this  $\div$  by the common Difference 2, gives 7 Days, the Answer.

(21) For A's Race thus,

First 4+40=44, Sum of the first and last Terms. Then 44+5, half the Number of Terms=220 Yards. A's first kace per Prop. the first.

Then 901×4=3604 yds. A's first Term of the last Race. Also 910×4=3640 A's last Term.

their Sum 7244 which  $\times$  5=36220 A's last Race. Then to find his whole Ground, put \$20 first Term. And 36220 the last Term, which (by Prop. 1.) is 36440 $\times$ 5=182200 Yards gone by A.

For B's, thus,

First 11 × 4=44 first Term. And 20 × 4=80 last Term, Then 44+80=124 their Sum, which × 5=620 Yards, B.'s first Race.

.. 911×4=3644 yds. B's first Term of the last Race.
920×4=3680 B's last Nace.

their Sum 7324 which  $\times 5 = 36620$  yds. B's last Race. Then 620 + 36620 = 37240 Sum of the first and last Terms. which  $\times 5 = 186200$  Yards gone by B.

Deduct 182200 ditto by A.

4000 Yards, common Difference.

Which added continually to each of their Shares, shew that 1 ds. Miles. Fur. 1 ds.

A in all ran 182200 = 103 40 186200 = 105 B 80 190200 = ,108 C 0 120 D 194200 = 110 160 2 E 198200 = 112200 4 F 202200 = 114 20 G 206200 = 117 60 1 H 210200 = 119 100 3 214200 = 121 I 140 K 218200 = 123 180 Sums 2002000 =1137 0

If 2002000: 300£. :: 182200 182200

2002,000)54660,000(27£.6s. 0½d. 500 A's Part. If 2002,000: 300£.:: 186200

2002,000) 55860,000 27 18  $0\frac{1}{2}$   $\frac{14}{1001}$  B's Part. 27 6  $0\frac{1}{2}$  590

Common Difference II 113 Toor

Whi

From

(t)

Nov

(2)

The

And Alfo

(3)

Which by continually adding to each we shall have

```
590 = A.'s
         6
First 27
              OF
                      14 = B.'s
          18
               OF
Then
     27
                     439 = C.'s
      28
               OA
          10
                    864 = D.'s
     29
          2
               0
                     288 = E.s
             0
      29
          14
                     713 = F.'s
              113
     30
          5
                     137 = G.'s
          17
              114
      30
              III
                     562 = H.s
      31
          9
                     987 = I.s
              II
          I.
      32
          13
              117
                     411 = K.'s
      32
```

Proof goo ? .o

From London to York suppose 180 Miles, which X4-720 Miles, twice a-back.

Their Sum Total 1137 M. 4 Fur. Distance of York 720

Short of the Undertaking 417 Miles.

# 35. GEOMETRICAL PROGRESSION.

(1) First \ \ \( \) 0. 1. 2. 3. 4. 5. Indices. \\ \( \) 1. 2. 4. 8. 16. 32. Terms.

Now, 5+5=10. Then 32×32=1024=10th Term.

Again 10+5=15. 1024×32=32768 Qrs. the
16th Term. As the Indices are less than the Terms
by one.

And 32768 Qrs. = £. 30. 2. 8. Q. E.F.

(2) First  $\begin{cases} 0.1.2.3.4.5.6. \\ 1.2.48.16.32.64. \end{cases}$ Then  $64 \times 64 = 4096 = 12th$  Term. And  $4096 \times 4096 = 16777216 = 24th$  Term. Also  $64 \times 32 = 2048 = 5 + 6 = 11th$  Term.

7 16777216 × 2048=34359738368 Farthings, or 36th Term, which reduced to Pounds, will give 35791394£. 25. 8d. the Answer.

(3) First { 0. 1. 2. 3. 4. 5. 6. Indices. 10. 30. 90. 270. 810. 2430. 7290. Terms. S 3

Now 5+6=11. Then, 2430×7290=17714700, which in the first Term gives 1771470£. the eldest Child's Fortune.

0 1 2 3 4 (4) 509. 750. 1125. 1687.5. 2531.25. 3796,875. 5+4=9 Number of Terms lefs 1.

Then 3796, 875×2531, 25=9610839, 84375. Which ÷ 500 the first Term=£.19221 135. 7d. 125.

(5) First \ 0. 1. 2. 3. 4. 5. 6. Indices. 1. 2. 4. 8. 16. 32. 64. Terms.

Now 5+6=11 Number of Terros less 1.

Then  $64 \times 32 = 2048$  laft Term. And 2047 - 1 = 2 - 1 = 2047.

Also 2048+2048=4095 Guineas, or £.4299 155.

(6) First \ \ 0. 1. 2. 3. 4. 5. 6. 1. 2. 4. 8. 16. 32. 64.

Then 6+6+6=18 Number of Terms less 1.
64×64×64=262144 last Term.
262144-1:2-1=262143,+262144=524287 Farthings: or, 546£. 2s. 7<sup>3</sup>/<sub>4</sub>d. what 20 Horses came to.
20)546 2 7<sup>3</sup>/<sub>4</sub>(27£. 6s. 1½d. 2<sup>7</sup>/<sub>2</sub> per Head the Answer.

(7) First  $\begin{cases} 0.1. & 2.3.4.5. \\ 2.6.18.54.162.486. \end{cases}$ Then  $486 \times 486 = 236196 = 5 + 5 = 10th$  Term. And  $486 \times 162 = 78732 = 5 + 4 = 9th$  Term.

Product 18596183472 last Term. —2 First.

Ratio 3-1=2)18596183470

9298091735 this added to the last Term,

gives 1,00)27894275207 the Sum of all the Terms at 4 per 100.

Value of the Pins  $278942752\frac{7}{100}$  Qrs. = 290565 7 4 Lace comes to f.8 1.  $8 \times 5 \times 4$  (20) = 161 13 4

Answer gained

29043 14 0

(8)

The

AB

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(3

-10

10 Ratio-9)99999999999

Pints.

768,0)11111111111,0(14467592 $\frac{45.5}{708}$ ABufhel=pts. 64)14467592(226056 $\frac{1}{8}$  Bufhels at 4s.
226056 $\frac{1}{8}$ 

2 See Case 4. P. 85. G.

45211.4.— 6 ½ of 4s.

Answer, £.45211.6

- (9) First 4. 2, 1. ½, ¼, and ad infinitum.

  Then 4×4=16 Square of the first Term.

  And 16÷2=8 Leagues, the Answer.
- (10) First 1,2 × 12=144 Square of the first Term.

  And 12-10=2 Difference of the first and second Term.

  Then 2)144(72 Miles, the Answer.

## 36. PERMUTATION.

- (1) First 1×2×3×4×5×6×7=5040 Days. Then 365)5040(13 Years, 295 Days, the Answer.
- (2) First 1×2×3×4×5×6×7×8×9×10×11×12=
  479001600 Rounds. Which×3=1437004800 Se.
  And in a Year there
  are 315576,00)1437004800(45 Years.

A Day=864,00)169848,00(96 Days.

An Hour=36.00)504,00(14 Hours. 45 Years, 96 Days, 14 Honrs, the Answer.

(3) First 1×2×3×4×5×6×7×8×9=362880 Days. And 20 Guinezs =5040 Pence. Then, as 362880 Days: 15040d.:: 365 D.: 543156d. per Year.

```
Reduction of Vulgar Fractions.
200
   38.
        REDUCTION OF VULGAR FRACTIONS.
                    CASE
(1) 336)896(2
        224)226(1
             112)334(2
 Then 112) 336 (=3, the Term required.
(2) 2832)12848(4 Then 16) 2832 (=177 the Answer.
          1520)2832(1
              1312)1520(1
                    208)1312(6
                          64)288(3
                           16)64(4
       144)560(3
                  Then 16) 144 (= 3 the Answer.
(3)
          128)144(1
              16)128(8
                     Then 48(336(=4 the Answer.
(4)
       192)336(1
           144)192(1
              48)144(3
                      Then 6) 1476 (= 246 the Answer.
(5)
      1476)1938(1
             462)1476(3
                   90)462(5
```

12)90(7

6)12(2

(7) (8)

(9)

(10)

(11)

(12)

(13) (14)

(15)

(16)

(17)

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- Thus  $\frac{12}{27}$  |  $\frac{900}{500}$  becomes  $\frac{19}{27}$  Terms required.

  6)  $\frac{42}{54}$   $\frac{90}{50}$  (= $\frac{7}{9}$  the Answer. (6)
- (7)
- $8)_{112}^{24} (=\frac{3}{14} + 12)_{324}^{96} (=\frac{8}{27} + 12)_{144}^{69} (\frac{3}{12} + \frac{3}{12})_{144}^{69} (\frac{3}{12} + \frac{3}{12})_{144}$ Thus (8)  $12\frac{120}{360}(=\frac{1}{5}$ And Answer, 3, 2, 15, and 1, the Fractions required.

#### CASE II.

- (9) Thus  $\frac{4}{3} \times \frac{5}{4} \times \frac{9}{10} = \frac{18}{63}, \frac{9}{9}$  or  $= \frac{2}{7}$  the Fraction. Or thus—of—of—= as before.
- (10) Thus  $\frac{2}{9} \times \frac{3}{4} \times \frac{4}{1} = \frac{34}{36}$  or  $\frac{2}{3}$ , the Fraction required. Or thus  $\frac{2}{g}$  of  $\frac{3}{4}$  of  $\frac{4}{1} = \frac{2}{3}$  as before.
- (11) Thus  $\frac{3}{7} \times \frac{1}{5} \times \frac{7}{8} = \frac{1}{163}$  or  $\frac{1}{8}$ , the Fraction required. Or thus  $\frac{3}{7}$  of  $\frac{1}{8}$  of  $\frac{7}{8} = \frac{1}{8}$  as before.

# CASE III.

- (12) Thus 12, 27, and 176, the Fractions required.
- (13) Thus 27 × 12=234, Then 324, the Fraction required.
- (14) Thus 7×4+2=30. Then 'o, the Fraction required.
- (15) Thus 16×2+1=33. Then 33, the Fraction required.
- (16) Thus 142×23+17=3283. Then 3283, the Answer.
- (17) Thus 146 ×37+21=5423. Then 5423, the Answer.

#### CASE IV.

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(18) Thus 30:7=42, the Answer.

(19) Thus 33 +2=16t, the Answer.

(20) Thus 3283 + 23=14213, the Answer.

(21) Thus 5423 -37=14621, the Answer.

#### CASE V.

(22)

First  $\begin{cases} \frac{3}{4}, \frac{7}{12}, \text{ and } \frac{7}{10} \\ 3 \times 12 \times 10 = 360 \\ 11 \times 4 \times 10 = 440 \\ 7 \times 12 \times 4 = 336 \end{cases}$  New Numerators.

And  $4 \times 12 \times 10 = 480$  Common Denominator.

And  $4 \times 12 \times 10 = 480$  Common Denominator Answer  $\frac{3}{4}\frac{69}{80}$ ,  $\frac{440}{4}\frac{69}{80}$ , and  $\frac{336}{480}$ .

(23) First,  ${}_{5}$  of  ${}_{8}^{7} = \frac{7}{48} \cdot \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \text{ and } \frac{1}{48}.$ Then  $\begin{cases} 1 \times 4 \times 5 \times 48 = 960 \\ 1 \times 3 \times 5 \times 48 = 720 \\ 1 \times 3 \times 4 \times 48 = 576 \\ 7 \times 5 \times 4 \times 3 = 420 \end{cases}$  New Numerators

And  $3 \times 4 \times 5 \times 48 = 2880$  Common Denominator. Answer  $\frac{2880}{2880}$ ,  $\frac{2880}{2880}$ ,  $\frac{576}{2880}$ , and  $\frac{420}{2880}$ .

 $\frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{4} \cdot \frac{1}{5}$  and  $\frac{1}{6}$ .

(24) First  $1 \times 3 \times 4 \times 5 \times 6 = 360$ Also  $1 \times 2 \times 4 \times 5 \times 6 = 240$   $1 \times 2 \times 3 \times 5 \times 6 = 180$   $1 \times 2 \times 3 \times 4 \times 6 = 144$   $1 \times 2 \times 3 \times 4 \times 5 = 120$ New Numerators.

And  $2\times3\times4\times5\times6=720$  Common Denominat. Answer  $\frac{362}{20}$ ,  $\frac{740}{20}$ ,  $\frac{120}{120}$ ,  $\frac{144}{20}$ , and  $\frac{120}{20}$ .

(25) First \$ of \$=\frac{9}{4}\$ or \$2\frac{7}{4}\$.

Then we have the Fractions \$\frac{5}{6}\$, \$\frac{7}{10}\$, \$\frac{3}{4}\$, and \$\frac{7}{4}\$.

Now  $\begin{cases} 5 \times 10 \times 4 \times 4 = 800 \\ 7 \times 6 \times 4 \times 4 = 672 \\ 3 \times 6 \times 10 \times 4 = 720 \\ 1 \times 4 \times 10 \times 6 = 240 \end{cases}$  New Numerators.

And 6×10× 4×4=960 Common Denominator. Answer \$ 960, 5760, and \$ 40

#### CASE VI.

- $\frac{3}{4 \times z_1} = \frac{1}{28}$ , the Fraction required. Thus3 (26)
- Thus  $\frac{1 \times 20 \times 12}{620} = \frac{12}{31}$ , the Fraction required. (27)
- (28) Thus  $\frac{3}{4\times4\times12\times27} = \frac{1}{1728}$ , the Fraction required.
- (29)
- Thus  $\frac{5}{7 \times 12 \times 20} = \frac{1}{336}$ , the Fraction required. Thus  $\frac{1 \times 21 \times 12 \times 4}{1344} = \frac{1008}{1344} \text{ or } \frac{3}{4}$ , the Fract. req. (30)
- Thus  $\frac{\delta}{6 \times 20 \times 12} = \frac{1}{288}$ , the Fraction required. (31)
- Thus  $\frac{3 \times 1 \times 2}{448} = \frac{3}{4}$ , the Fraction required. (32)
- Thus  $\frac{3}{4 \times 16 \times 10 \times 112} = \frac{3}{114638}$ , the Fract. req. (33)
- Thus  $\frac{5\times 12\times 20}{134} = \frac{25}{2}$ , the Fraction required. (34)
- Thus  $\frac{7 \times 2 \times 8 \times 40}{9} = \frac{2240}{9}$ , the Fraction required. (35)
- Thus  $\frac{7\times4\times4}{45}$  =  $\frac{112}{45}$ , the Fraction required. (36)
- Thus  $\frac{11}{12 \times 63} = \frac{11}{756}$ , the Fraction required. (37)
- Thus  $\frac{7\times48\times8}{9} = \frac{896}{3}$ , The Fraction required. (38)
- Thus  $\frac{7 \times 36}{142} = \frac{126}{71}$ , the Fraction required. (39)
- Thus  $\frac{3}{5\times8\times30} = \frac{1}{480}$ , the Fraction required. (40)
- Thus 7 × 7×24×60×60 = 2116800, the Fraction (41) required.
- Thus 11×60×24 1584, the Fraction required. (42)

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	Ź	ASE VII.		
(43)	367 Moider 9×3=27		Guineas.	
12	96)9909(75,	12)105		
Rema	ins837s. ×12	Answer 8	s. 9d.	
1296)	10044(7d.	(45) 5 ×12	S. (1)	
Remair	ns 972d. ×4	X12 8)60		
. 1296)	3888(3 Qrs.	Answer 7 2d.		
Answer	7s. 7\d.		- 1 T	
(46)	£. s. 3 12 ×4	(47) ×2	5£.	
	5)14 8	7)10		
Answe	er 2177 5	Aniwer	4s. 3\frac{1}{4}d.\frac{5}{7}.	
(48)	lb. 411	<b>`**</b>	cat.	
	X13		×4	
72	20)4932(6 oz.	3.8	)28	
Rema	ins 612 X 20	Answer 3qrs. 3lb. 10	z. 124drs.	
72,0	)1224,0(17dwts	(50) Ton 63 ×20		
	504			
Answer	6 oz. 17 dwts.	124)1260	(10 cwt.	
		D:		

A

Remains 20

Reduction of	Vulgar Fractions. 205
Brought over 124)2240(18 lb.	(5 <sup>1</sup> ) 7 ×8
1,000	8)56
Remains 8 × 16	Answer 7 Furlongs.
124)128(10 Remains 4	(52) Ell Eng. 5
Answer 10 C. 18lb. 1 1 0	z
(53) Acres. 4 (53) 7 (53) ×4 (8) 28	Anfwer 3 Qrs. (54) Hhd. W.
Answer 3 Rds. 20 Pol	252)756(3 Qts.
(55) <b>7</b> Ba. B.	Remains 189 ×4 252(756(3 Qts.
9)152	Answer 2 Galls 3 Qts.
Answer 28 Galls.	r sollon and to the same of th
(56) Chal.	(57) Months.
72)900(12 Bush.	8) <sub>28</sub>
Remains 36 Bush.	Answer Weeks 3. 3. 12.
72)144(2 Pecks.	(58) 1115 Days.
Answer 12 Bush, 2 Pe	7)120
	Answer Hours 17. 8. 342

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#### CASE VIII.

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(59) First 6s. 8\frac{1}{2}d = 161 Halfpence and 1\int .=480 ditto.

Then \frac{161}{480} is the Fraction required.

(60) First 41d.=9 Halfpence; and 1s.=24 Anf. 24 or 38.

(61) First 26. 175.7 $\frac{1}{5}d$ .=3456 Fifths. Ans.  $\frac{3456}{4326}$  or  $\frac{4}{5}$ . And 36. 125.— =4320 ditto.

(62) First 8s. 2d. = 98 Pence. Answer  $\frac{98}{252}$  or  $\frac{7}{18}$ .

And 1£. 15.=252 ditto. (63) First 6 oz 17 dwts. 21 grs.=3309 grs.

And 1lb. = 5760 Anf. 3309 or 1013.

(64) First 3 qrs. 3 lb. 1 oz.  $12\frac{5}{9} = 200705$  Ninths.

And 1 Cwt. = 258048 Answer  $\frac{200705}{528048}$ 

(65) First 10 Cwt. 18 lb  $1\frac{1}{81}$  oz. = 564480 or  $\frac{63}{124}$  Apswer. And 1 Ten = 1111040

(66) First 3 Qrs.  $\frac{1}{8} = 25$  Eighths. or  $\frac{5}{8}$ , the Answer. And 1 Ell Eng. = 40

(67) First 2 Feet 6 Inch.=30 Inches. or 5, the Answer.

And 1 Yard =36

(68) First 4 Fur. 32 p.=192 Poles. or 3, the Answer.

And 1 Mile =320

(69) First 3 Roods 2 p.=122 Poles. or 61/80, the Answer.

And 1 Acre = 160

(70) Thus  $\frac{42}{63}$  or  $\frac{2}{3}$  the Fraction required. (71) Thus  $\frac{28}{36}$  or  $\frac{2}{5}$ , the Fraction required.

(72) First 14 Bush. 2 Pks.=58 Pecks. or 29, the Answer.
And a Chaldron. =144

(73) First I W. 3 d. 12 h.=252 Hours. or 3, the Answer.

And I Month = 672

(74) First 243 D. 8 h.=5840 Hours. or  $\frac{2}{3}$ , the Answer.

And 1 Year. =8760

# 39. ADDITION of VULGAR FRACTIONS.

(1) Thus  $\frac{3}{7} + \frac{1}{4} + \frac{5}{6} = \frac{7}{68} + \frac{42}{68} + \frac{140}{68} = \frac{254}{168}$  or  $1\frac{43}{84}$  Answer.

(2) Thus  $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \frac{5}{6} = \frac{3}{720} + \frac{4}{9} + \frac{5}{9} + \frac{5$ 

(3) Then  $\frac{8}{15} + \frac{13}{15} = \frac{21}{15}$  or  $1\frac{2}{5}$ , the Sum required.

- (4) First \(\frac{3}{7}\) of \(\frac{5}{6} = \frac{5}{4}\), and \(\frac{5}{9}\) of \(\frac{3}{4} = \frac{5}{2}\). Then  $\frac{5}{14} + \frac{5}{12} = \frac{60}{168} + \frac{70}{168} = \frac{130}{168}$  or  $\frac{65}{84}$ , the Sum req.
- (5) First 1 of 5 =16, (fee Note Cale II.) Then  $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{72}{144} + \frac{40}{144} + \frac{56}{144} + \frac{24}{144} = \frac{180}{144}$  or 11 the Sum required.
- (6) First  $\frac{1}{2} + \frac{3}{4} = \frac{4}{8} + \frac{6}{8}$  or  $\frac{2}{4} + \frac{3}{4} = \frac{5}{4}$  or  $1\frac{1}{4}$ . Then  $4 + 17 + \frac{1}{4} = \frac{1}{4}$ 14=224, the Sam required.
- (7) First  $\frac{2}{3} + \frac{4}{5} + \frac{7}{10} = \frac{100}{150} + \frac{120}{150} + \frac{105}{150} = \frac{325}{50}$  or  $2\frac{1}{6}$ . Then 7+9+6+2=246, the Sum required.
- (8) First  $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \frac{5}{6} = \frac{360}{720} + \frac{80}{720} + \frac{576}{720} + \frac{576}{720} + \frac{600}{720} =$ 2556 or 311.
  - Then 8+9+10+11+12+311=5311, the Sum req.
- (9) First of 1s. = 1 of 1f. per Cafe VI. Then  $\frac{201}{460} + \frac{1}{160} = \frac{32160}{73600} + \frac{460}{73600} = \frac{32620}{73600}$  or  $\frac{1631}{3680}$ . which by Cate VII.=8s. 1014d. 13.
- (10) First \(\frac{3}{8}\) of an oz. = \(\frac{3}{9}\) or \(\frac{1}{2}\) of a lb. Then  $\frac{1}{4} + \frac{1}{32} = \frac{32}{128} + \frac{4}{128} = \frac{36}{128} = \frac{9}{32}$  lb. or 3 oz. 7 dwts. 12 grs. the Sum required.
- (11) First  $\frac{1}{3}$  of a lb.= $\frac{1}{336}$  of a Cwt. Then  $\frac{5}{8} + \frac{1}{336} = \frac{1680}{2688} + \frac{8}{2688} = \frac{1688}{2688} = \frac{211}{330}$  Cwt.or2qrs. 14 lb. 5 oz. 5 drs. the Answer.
- (12) First 2 of an Ell Eng .= 2 of a Yard. Then  $\frac{3}{4} + \frac{2}{4} = \frac{5}{4}$  yd. or 1 yd. 1 qr. the Sum required.
- (13) First \(\frac{2}{3}\) of a Yard \(-\frac{2}{5230}\) or \(\frac{7}{2640}\) of a Mile. Then  $\frac{5}{6} + \frac{1}{2640} = \frac{18000}{15840} + \frac{6}{15840} = \frac{13206}{15840} = \frac{2201}{2640}$  Mile. or 6 Fur. 26 p. 4 yds. 1 ft. the Sum required.
- (14) First \(\frac{1}{2}\) of a Peck=\(\frac{1}{288}\) of a Chaldron. Then  $\frac{3}{8} + \frac{1}{288} = \frac{64}{2304} + \frac{8}{2304} = \frac{872}{2304} = \frac{109}{288}$  or 13 Bush.

  2 pks. 1 gall. the Sum required.
- (15) First 3 of a Week= 3 of a Month. Then  $\frac{3}{16} + \frac{5}{6} = \frac{18}{96} + \frac{80}{96} = \frac{98}{96} = \frac{49}{48}$  Mon. or 1 m. 14 hrs. the Sum required.
- (16) First \( \frac{3}{4} \) of an Hour=\( \frac{3}{672} \) or \( \frac{1}{224} \) of a Week. Then  $\frac{1}{224} + \frac{5}{8} = \frac{8}{792} + \frac{1129}{1792} = \frac{141}{224}$  or 4 D. 9 h. 45 m. the Sum required.
- (17) First  $\frac{3}{5}$  of  $12f = \frac{24}{5}$  or  $4\frac{4}{5}f$ . and  $\frac{1}{5}$  of  $\frac{9}{10} = \frac{9}{50}$ .
  - - Then 4+4+1  $\frac{607}{1400}=9$   $\frac{607}{1400}$  f. or 9f. 8s. 8d.  $\frac{2}{35}$ , the Sum required.

# 40. SUBTRACTION of VULGAR FRACTIONS.

(1) Thus  $\frac{11}{12} - \frac{2}{9} = \frac{99}{108} - \frac{24}{108} = \frac{75}{108}$ , or  $\frac{25}{36}$ , the Diff. req. (2) Thus  $\frac{19}{64} - \frac{2}{13} = \frac{247}{832} - \frac{128}{832} = \frac{119}{832}$ , the Diff. required. (3) Thus  $\frac{14}{17} - \frac{7}{11} = \frac{154}{187} - \frac{119}{187} = \frac{35}{187}$ , the Diff. required.

(4) First 3 of 7 = 21. Then  $\frac{21}{32} - \frac{2}{5} = \frac{105}{160} - \frac{64}{160} = \frac{41}{160}$ , the Diff. required.

(5) First  $\frac{5}{6}$  of  $\frac{7}{10} = \frac{7}{12}$ , and  $\frac{2}{3}$  of  $\frac{1}{2} = \frac{1}{3}$ . Then  $\frac{7}{12} - \frac{1}{3} = \frac{21}{36} - \frac{12}{36} = \frac{9}{36}$  or  $\frac{1}{4}$ , the Diff. required. (6) Thus  $10\frac{3}{4} - 6\frac{5}{6} = 10\frac{12}{24} - 6\frac{20}{24} = 3\frac{22}{24}$  or  $3\frac{11}{2}$ , the Diff.

(7) Thus  $17\frac{1}{12} - 16\frac{6}{7} = 17\frac{77}{84} - 16\frac{72}{84} - 1\frac{5}{84}$ , the Diff. (8) First \(\frac{5}{6}\) of \(\frac{7}{8}\) of \(\frac{3}{4} = \frac{35}{64}\).

Then  $12 - \frac{35}{64} = 11\frac{29}{64}$ , the Difference.

(9) First 3 of a Penny=3 or 16 of is. per Case VI

Then  $\frac{2}{3} - \frac{1}{16} = \frac{22}{48} - \frac{3}{48} = \frac{19}{48}$ s. or  $7\frac{1}{4}d$ . per CaseVII. Ans. (10) First  $\frac{3}{4}$  of an oz.  $= \frac{3}{7168}$  of a Cwt. Then  $\frac{3}{3}$   $\frac{3}{7168}$   $\frac{7168}{21504}$   $\frac{8}{21504}$   $\frac{7159}{21504}$  C. or 1qr. 9lb. 4 oz.  $9\frac{1}{8}$  drs. the Difference required.

(11) First \(\frac{3}{8}\) of an Inch=\(\frac{3}{288}\) or \(\frac{1}{96}\) of a Yard. Then  $\frac{3}{4}$   $\frac{1}{96}$  =  $\frac{288}{384}$   $\frac{4}{384}$  =  $\frac{284}{384}$  =  $\frac{71}{6}$  Yd, or 2 ft.  $2\frac{5}{8}$  in. the Difference required.

(12) First \(\frac{3}{4}\) of a Peck=\(\frac{3}{576}\) or \(\frac{1}{192}\) of a Chaldron. Then  $\frac{3}{8} - \frac{1}{15} = \frac{76}{1536} - \frac{8}{1536} = \frac{508}{1536} = \frac{71}{153}$  Chal. or 13 Bush. 1 Pk. 1 Gall. the Difference.

(13) First & of an Hour= 3 or 3 of a Day. Then  $\frac{5}{6} - \frac{1}{32} = \frac{160}{192} - \frac{6}{192} = \frac{77}{96}$  Day; or 19 h. 15 min. the Difference.

# 41. MULTIPLICATION of VULGAR FRACTIONS.

(1) Thus  $\frac{6}{11} \times \frac{7}{12} = \frac{7}{22}$  (fee Note in Page 136) the Product required.

(2) Thus 12½ ×6=75, the Product required.

(3) First 173=88 Then  $\frac{88}{5} \times \frac{7}{8} = \frac{77}{5}$  or  $15\frac{2}{5}$ , the Product required.

(4) First 23=11, and 3 of 7 = 21. Then  $\frac{1}{4} \times \frac{21}{32} = \frac{231}{128}$  or  $1\frac{108}{128}$ , the Product required.

(5) First 121=11, and 8 of 12=21. Then \$ 1 × 21 = 10718 or 1337, the Product required. (6) (7)

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- (6) Frft \$ of 10 = 15. pover see to beautifulate Then \(\frac{15}{22}\times \frac{6}{1} = \frac{45}{11}\) or 47\,\frac{1}{1}\), the Product required.
- (7) First \(\frac{7}{8}\) of \(\frac{3}{4} = \frac{21}{32}\) and \(\frac{2}{3}\) of \(\frac{5}{7}\) of \(\frac{1}{4} = \frac{4}{3}\). Then \$\frac{21}{32} \times \frac{4}{1} = \frac{2}{8}, or 2\frac{5}{8}, the Product.
- dr bha 8 and (8) First 33=11. Then  $\frac{1}{3} \times \frac{1}{7} = \frac{1}{2}\frac{1}{7}$ . Also  $\frac{3}{5}$  of  $\frac{3}{4} = \frac{9}{20}$ . Again 11 X = 0 140, the Product required.

## 42. DIVISION OF VULGAR FRACTIONS.

- (1) Thus  $\frac{6}{7} \div \frac{3}{5}$  or  $\frac{6}{7} \times \frac{5}{3} = \frac{1}{7}$  or  $1\frac{3}{7}$ , the Quotient required.
- (2) First \(\frac{2}{3}\) of \(\frac{7}{8} = \frac{7}{2}\). Then  $\frac{2}{15} \div \frac{7}{12}$  or  $\frac{2}{15} \times \frac{7}{12} = \frac{24}{77}$ , the Quotient required.
- (3) First 121=25, and 173=53. Then  $2\frac{1}{2}$  ÷  $5\frac{3}{3}$  or  $2\frac{5}{2} \times \frac{3}{5\frac{3}{3}} = \frac{75}{106}$ , the Quotient required.
- (4) First  $12\frac{3}{4} = \frac{5}{4}$ , and  $3\frac{7}{8} = \frac{3}{8}$ . Then  $\frac{5}{4} \div \frac{3}{4}$  or  $\frac{5}{4} \times \frac{8}{3} = \frac{5}{3}$  or  $3\frac{3}{3}$ , the Quot. req.
- (5) First  $\frac{7}{8}$  of  $\frac{3}{4} = \frac{21}{32}$ , and  $\frac{2}{5}$  of  $\frac{12}{7} = \frac{24}{5}$ . Then  $\frac{21}{32}$   $\div$   $\frac{24}{5}$  or  $\frac{21}{32} \times \frac{5}{24} = \frac{35}{256}$ , the Quotient required.
- (6) First  $7\frac{2}{7} = \frac{5}{7}$ , then  $5\frac{1}{7} \div \frac{9}{1}$  or  $\frac{5}{7} \times \frac{1}{9} = \frac{17}{27}$ , the Quot. (7) Thus  $9\frac{6}{1} \div \frac{14}{4}$  or  $9\frac{6}{1} \times \frac{1}{146} = \frac{4}{73}$ , the Quot. required.
- (8) First 143=101, and 3 of 12=31.
- Then  $\frac{101}{7}$   $\frac{101}{1}$  or  $\frac{101}{7}$   $\times \frac{1}{9} = \frac{101}{63}$  or  $\frac{188}{63}$ , the Quot. req. (9) First 14272=1711, and 123=63.
- Then  $\frac{171}{12}$   $\div \frac{63}{5}$  or  $\frac{171}{12}$   $\times \frac{5}{63} = \frac{85}{736}$  or  $11\frac{239}{756}$ , the Quotient required.
- (10) First  $\frac{7}{8}$  of  $\frac{6}{1} = \frac{2}{4}$ , and  $\frac{3}{4}$  of  $\frac{6}{7}$  of  $\frac{1}{17} = \frac{33}{56}$ . Then 21 + 33 or 21 × 56 = 1176 or 819, the Quot. req.

If the Divisor and Dividend have both the same Denominator, the Quotient may be found by dividing one Numerator by the other.

- Thus 7 + 14; thus 7 + 4=4. the Quotient required.
- 2. If the Divisor and Dividend have each the same Numerator, divide one of the Denominators by the other, which will give the Quotient required:
  - Divide  $\frac{8}{17}$  by  $\frac{8}{17}$ ; thus  $17 \div 11 = \frac{11}{17}$  the Quotient.
- 3d. If a Number can be found that will divide both the Numerators, or both the Denominators, (viz. those of the Divisor and Dividend) without a Remainder; use those Quo-

# 10 The Rule of Three Direct in Vulgar Fractions.

tients instead of the given Numerators and Denominators, which will give the Refult in its lowest Terms.

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Divide  $\frac{3}{15}$  by  $\frac{9}{16}$ ; thus  $\frac{8}{15} \div \frac{9}{16} = \frac{1}{5} \div \frac{3}{2} = \frac{3}{15}$ , the Quo.

tient required.

For 8 and 16 divide by 8, also 15 and 9 divide by 3.

# 43. THE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

(1) If  $2\frac{2}{5}$  yds. :  $3\frac{1}{4}$  £.  $4\frac{4}{5}$  yds. Or

As  $\frac{1}{3}$  :  $\frac{1}{4}$  ::  $\frac{2}{4}$  ::  $\frac{1}{5}$  £.

For  $\left\{\begin{array}{c} 24 \times 15 \times 5 \\ 12 \times 4 \times 5 \end{array}\right\} = \frac{1}{2}$ £. or 7£. 10s. the Answer.

(2) First 5s. 6d.= $\frac{11}{40}$ £. Then

As  $\frac{1}{4}:\frac{1}{40}::\frac{33}{8}::\frac{243}{80}$ £.

For  $\left\{\begin{array}{c} 339\times11\times4\\ 3\times40\times8 \end{array}\right\}=:\frac{243}{80}$ £. or 15£. 10s. 9d. the Answer.

(3) First 14s. 8d. or  $14\frac{2}{3} = \frac{11}{15}f$ . Then

As  $\frac{7}{9} : \frac{11}{15} :: \frac{8}{1} :: \frac{264}{35}$ .

For  $\left\{ \begin{array}{l} 9 \times 11 \times 8 \\ 7 \times 15 \times 1 \end{array} \right\} = \frac{264}{35}f$ . or 7f. 10s.  $10\frac{1}{4}d$ .  $\frac{1}{7}$  the Anf.

(4) First  $10\frac{1}{2} = \frac{21}{2} f$ , and  $2700\frac{1}{2} = \frac{549}{2}$ . As  $10\frac{1}{2} : \frac{21}{2} : \frac{540}{2} : \frac{113}{400} f$ . For  $\begin{cases} 5401 \times 21 \\ 100 \times 2 \times 2 \end{cases} = \frac{113}{400} f$ . or 283 f. 115,  $0\frac{1}{2} d_2^2$ . the Answer.

(5) First 112  $\frac{8}{8} = \frac{90 \text{ i}}{8} \pounds$ . Then

As  $\frac{90 \text{ i}}{8} : \frac{100}{9} : \frac{1279}{9} : \frac{1016000}{907}$ .

For  $\left\{\begin{array}{c} 1270 \times 8 \times 100 \\ 901 \times 1 \times 1 \end{array}\right\} = \frac{1016000}{907} \text{ or } 1127 \pounds 125.1\frac{1}{2}d$ .

(6) First  $4\frac{3}{4} = \frac{19}{4}$  Pieces. And  $22\frac{3}{8} = \frac{179}{8}$  Yards in each Piece. Then  $\frac{179}{8} \times \frac{19}{4} = \frac{240}{32}$  Yards bought. Also, 8s.  $9d = \frac{7}{16}f$ . Therefore, As  $\frac{1}{1} : \frac{7}{16} :: \frac{340}{32} : \frac{23\frac{807}{512}}{512}$ For  $\left\{ \frac{3401 \times 7}{32 \times 16} \right\} = \frac{23\frac{307}{512}f}{512}$ . or 46f. 9s.  $11\frac{1}{2}d \cdot \frac{1}{4}$  the Answer.

(7) First 100f. 10s. 6d.=4021f. and 5s. 63d.=330f. Alfo I Ell. Fl.=3 Ell Bing. Therefore,

As  $\frac{89}{320}: \frac{3}{5}: \frac{4021}{40}, \frac{96504}{445}$ 

For  $\left\{ \begin{array}{c} 4021 \times 320 \times 3 \\ 89 \times 5 \times 40 \end{array} \right\} = 96\frac{504}{445}$  Ells Eng.

Now 96304: 12 8042 or 18 32 Ells Eng. in each Piece.

44. THE RULE OF THREE INVERSE.

- (1) First 251=76 t. and 63=27 Months. Alfo 103=43f. Then As 76 : 27 :: 43 : 684 M.  ${76 \times 27 \times 4 \atop 43 \times 4 \times 3} = {684 \atop 43} \text{ M. or } 15 \text{ M. } 27 = {9 \atop 43} \text{ days,}$ the Answer.
- (2) First 123 = 5 1 Hours. Then As 4: 51 :: 12: 51 Hours,  $\{51\times4\}=\frac{7}{4}$  Hours, or  $4\frac{1}{4}$  Hours, the Anf. 112X45
- (3) First 123=38 Oz. and 83=34 ditto. Then As 18 : 5 :: 35 : 1525.  $\{38 \times 5 \times 4\} = \frac{52}{27}$  or 7s.  $2\frac{3}{4}d$ .  $\frac{3}{7}$  the Answer.
- (4) First  $100\frac{2}{3} = \frac{30\frac{2}{3}}{3}f$ . and  $6\frac{2}{3} = \frac{20}{3}$  M. or  $\frac{20}{3}$  of  $\frac{1}{12}$  $\frac{5}{9}$  Yr. Alfo  $3\frac{5}{6} = \frac{23}{6}$  Yrs. As  $\frac{5}{9}$ :  $\frac{3 \circ 2}{3}$ :  $\frac{23}{6}$ :  $\frac{3 \circ 2 \circ 7}{2 \circ 7}$ Then For  $\left\{ \frac{302 \times 5 \times 6}{23 \times 3 \times 9} \right\} = \frac{3020}{207} \mathcal{L}$  or 14£. 115.  $9\frac{15}{46}$  d. the Answer.
- (5) First 8= 17 s. and 26 = 213 Yards. Also 5s. 7d. = 67 s. Then As  $\frac{67}{12}$ :  $21\frac{3}{8}$ :  $1\frac{7}{2}$ :  $1\frac{4271}{810}$ . For  $\left\{\begin{array}{c} 213 \times 67 \times 2 \\ 12 \times 17 \times 8 \end{array}\right\} = \frac{4757}{872}$  Yds. or  $17\frac{233}{272}$  Yards, the Anfwer.

### 45. THE DOUBLE RULE OF THREE.

- (1) First 4f. 15s.  $= 4\frac{3}{4}f$ . or  $\frac{19}{4}f$ . and 9M.  $= \frac{3}{4}$  Yr. Then 100f. 1 Yr. : 6f.  $| Now \frac{3}{4} \times \frac{6}{1} = \frac{9}{2}$  Divisor.  $-: \frac{3}{4} : \frac{19}{4} | And \frac{100}{1} \times \frac{19}{4} = \frac{47}{1}$  Dividend. Then  $\frac{47}{1} \div \frac{19}{2} = \frac{9}{1}$  or 105f. 11s.  $1\frac{1}{4}d$ .  $\frac{1}{3}$ , the Answ. Or by two Statings thus 1st. As 1:  $100: : \frac{3}{4}: \frac{400}{3}$ . 2d. As  $\frac{6}{1}: \frac{400}{3}: : \frac{19}{4}: \frac{950}{6}$  or 105f. 11s.  $1\frac{7}{4}d$ .  $\frac{1}{3}$
- (2) First 14 f. 6s. 8d. = 14 $\frac{1}{3}$  or  $\frac{43}{3}$  f. Then 12 Stu.: 16 D:  $\frac{43}{3}$  f. | Now 12 × 16 = 192 Divisor. 18: 34: - | And  $\frac{43}{3}$  ×  $\frac{34}{4}$  ×  $\frac{8}{1}$  =  $\frac{877}{2}$  Divid. Then 8772 ÷ 192 = 45 f. 13s. 9d. the Answer. Or thus, 1st. As  $\frac{12}{7}$ :  $\frac{43}{3}$ ::  $\frac{18}{1}$ :  $\frac{43}{2}$  f. 2d. As  $\frac{16}{1}$ :  $\frac{43}{2}$ ::  $\frac{34}{1}$ :  $\frac{73}{16}$  or  $\frac{45}{16}$ . 13s. 9d.
- (3) First 16£. 13s.  $4d = 16\frac{2}{3}$  or  $\frac{50}{3}$ £. And 6£. 17s 6d.=  $6\frac{7}{8}$  or  $\frac{55}{8}$ £. Then
  40 Cwt.: 30 M.  $\frac{50}{3}$ £. | Now  $\frac{50}{3} \times \frac{80}{1} = \frac{4000}{3}$  Divisor.

  —: 80:  $\frac{55}{8}$  | And  $\frac{40}{1} \times \frac{30}{1} \times \frac{55}{8} = \frac{8250}{1}$  Div.
  Then  $\frac{8250}{1} \div \frac{4000}{3} = \frac{99}{16}$  Cwt. or 6 Cwt. 21lbs. the Answ.
  Or, thus, 1st. As 30: 40::80: 15 Cwt.
  2d. As  $\frac{50}{3}$ :  $\frac{15}{1}$ ::  $\frac{55}{8}$ :  $\frac{95}{16}$  or 6 Cwt. 21lbs.
- (4) First  $26\xi$ . 198.  $4d.=26\frac{29}{36}$  or  $8\frac{99}{30}\xi$ . And  $14\xi$ . 158.  $=14\frac{3}{4}$  or  $5\frac{9}{4}\xi$ .

  12 Per. 3 M.:  $8\frac{99}{30}\xi$ . | Now  $8\frac{99}{30}\times 3\frac{6}{1}=485\frac{4}{5}$  Divisor.  $36:-:5\frac{9}{4}$  | And  $5\frac{9}{4}\times 1\frac{2}{7}\times \frac{3}{1}=5\frac{3}{7}$  Divid. Then  $5\frac{3}{1}\frac{1}{1}\frac{1}{1}485\frac{4}{5}=\frac{2}{485\frac{5}{4}}$  M. or  $16\frac{3}{8}\frac{3}{9}\frac{1}{9}$  Days, the Answer. Or thus, 1st. As 12:3:36:1 Months. 2d. As  $8\frac{99}{30}:\frac{1}{1}::5\frac{9}{4}:\frac{885}{18}$  Mo. or  $16\frac{33}{809}$  Days.
- (5) 30 M: 11D. 1 W. | Now  $\frac{11}{5} \times \frac{1}{4} = \frac{11}{5}$  Divifor.

   :  $\frac{11}{5}$ : 4 | And 30 × 11 × 4=1320 Divid.

  Then  $\frac{1320}{7} \div \frac{11}{15} = \frac{6600}{77}$  or 600 Men the Answer.

  Or thus, 1st. As 1: 30:: 4: 120 Men.

  2d. As 11: 120::  $\frac{11}{5}$ :  $\frac{6600}{1}$  or 600 Men.

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(6) First 21 = 5 Tons. And 3-10 = 270 or 20 Miles. Also 1 of 3 of 1 = 6 3 Likewise 1 Cwt. = 1 Ton. Then

 $\frac{1}{2}$  T.:  $\frac{29}{10}$  M.:  $\frac{63}{40}$  s. | Now  $\frac{29}{10} \times \frac{5}{2} = \frac{29}{4}$  Divisor.  $\frac{1}{20}$  : 1 : — | And  $\frac{63}{40} \times \frac{1}{20} = \frac{63}{500}$  Dividend.

Then  $\frac{63}{800} \cdot \frac{29}{4} = \frac{252}{23200}$  s. or  $\frac{378}{725}$  Qr. the Answer. Or thus, 1st. As  $\frac{5}{2} : \frac{63}{40} : : \frac{1}{20} : \frac{63}{2000}$ .

2d. As  $\frac{29}{70}$ :  $\frac{63}{2000}$ : :  $\frac{1}{7}$ :  $\frac{252}{23200}$ s. or  $\frac{378}{795}$  Qr.

## 46. QUESTIONS IN VULGAR FRACTIONS.

(1) Thus 999 the Answer. For == 1, and 99+1=100.

(2) First 3 of 18 of 141 = 1260.

.: 1-1269-12485 Anfw. For 1269+1216-1, Prcof.

(3) First 1 of 7 = 200, and 1 of 47 = 304.

3 200 304 3 60800 60800 = 2 53 528 or 2 65 1 the Anfwer.

For 253528 -62128 = 251400 which added to 69800 = 3, the Proof.

(4) First -1 of 12-12, and 19 of 27-27.

Then  $\frac{12}{17} + \frac{27}{19} = \frac{228}{209} + \frac{207}{209} = \frac{525}{209} = 2\frac{107}{209}$ . Again  $7\frac{1}{2} = \frac{1}{3}$ , then  $\frac{1}{3}$  of  $\frac{1}{3} = \frac{5}{2}$ ; also  $1\frac{1}{4} = \frac{5}{4}$ , and  $\frac{20}{30}$  of  $\frac{3}{4} = \frac{29}{24}$ ; then  $\frac{5}{2} = \frac{29}{24} = \frac{31}{24}$  or  $1\frac{7}{24}$ , which added to

 $8=9_{24}$ : 927-2107-91463-22568-63016, the Answer.

(5) First of 7 of 1 = 231.

 $\frac{1}{1} + \frac{231}{128} = \frac{128}{237}$  the Number, therefore,  $\frac{128}{231} \times \frac{128}{231} \times \frac{128}{237}$ = 120 17132, the Cube of that Number.

(6) First  $\frac{2}{3}$  of  $\frac{3}{16} = \frac{1}{8}$ , and  $9\frac{28}{27} = \frac{361}{37}$ .  $3\frac{5}{37} \times \frac{1}{8} = \frac{36}{296}$ , the Number.

And 361 × 261 = 130321 or 142705 Sqr.

(7) First  $\frac{3}{7}$  of  $\frac{4}{5}$  of  $\frac{7}{8} = \frac{87616}{10}$ ; also  $\frac{1}{5}$  of  $\frac{1}{7}$  of  $\frac{1}{13} = \frac{2}{273}$ .

Then, as  $\frac{3}{10}$ ;  $\frac{22}{273}$ ;  $\frac{12000}{1}$ :  $\frac{880000}{273} = 3223$ £. 8s.  $10\frac{1}{4}$ d.  $\frac{45}{77}$ , the Value of the Ship.

: 12000+3223f. 8s. 104d. 45=15223f. 8s. 104d.45 the Answer.

(8) First \(\frac{3}{4}\) of \(\frac{3}{5} = \frac{9}{20}\) fold. Then, as \(\frac{7}{20}\): \(\frac{17}{1}\): \(\frac{20}{20}\) or \(\frac{1}{7}\). : 11403=3800 £. the Answer.

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(9) His whole Estate  $\frac{83}{83} - \frac{34}{83} = \frac{49}{83}$ . Then  $\frac{34}{83}$  of  $\frac{43}{83} = \frac{1666}{6889}$ youngest Son's Part; and 34=2882 eldest.  $\begin{array}{l} \cdot \frac{2872}{6889} - \frac{1150}{6889} = 57 \text{£. 3s. 4d. or } \\ \text{Alfo } \frac{2822}{6889} + \frac{1666}{6889} = \frac{1488}{6889} \text{ both the Son's Part.} \\ \end{array}$ (14) So that 6889 4488 2401, Widow's Part. Then by rejecting the Common Denominator we shall have the following Proportion. £. s. d. As 1156: 1543 :: 2401: 3704743 = 584 7 3 684 3468 Widow had the Use of. As 1156: 1543 :: 2822: 2177173 = 627 15 94 3244 eldest Son had. As 1156: 1543 :: 1666: 123 3 468 = 370 12 5 4 3 468 His whole Estate 1622 10 10 4 3224 (10) First  $\frac{19}{30} - \frac{11}{39} = \frac{741}{1770} - \frac{339}{1770} = \frac{411}{170}$ . Then, As  $\frac{411}{170}$ :  $\frac{1081}{2}$ £. ::  $\frac{1170}{1170}$  or:  $\frac{1}{1}$ :  $\frac{632385}{411} = 1538$ £. 125. 113d. 267, the Answer. (11) First 4000 his whole Stock. Then  $\frac{5}{8}$  of  $\frac{2}{3}$  of  $4000 = 1666\frac{2}{3}$  Mad Tom took. 2333 = 700 g left. 2 of 5 of 7000 5831 = Raving Ned took. = 1750 left.  $\frac{7}{10}$  of  $\frac{17}{20}$  of 1750 = 10414 Positive Jack took. 7084=70848 left. 3 of 1 of 28354 13257 Dolly had. Answer 575 5 left (12) As  $\frac{5}{12}$ : 2200 ::  $\frac{1}{12}$  or :  $\frac{1}{1}$ =5280 £. Brother's Fortune. And  $5280 \times 3\frac{1}{8} = 16500$ ; also  $1\frac{1}{2} = \frac{3}{2}$ . : 16500 ÷ \(\frac{3}{2} = \frac{3}{3} \cdot \frac{0}{3} = 11000 \int. \) Father's Part. (13) J. S. First 175 Hhds: at 34£. each=34×17= 0 578  $A_{5} \frac{4}{7} : {}^{57} \frac{8}{1} :: \frac{7}{7} : {}^{404} \frac{6}{4} =$ 1011 10 13 Guns at 18f. 10s. each=18f. 10s. ×13= 240 10

Value of what was cast overboard 1830

Then \(\frac{3}{7}\) of \(\frac{3}{3} = \frac{27}{91} = 1830\)\(\epsilon\). and \(\frac{27}{91} + \frac{64}{94} = \frac{91}{91}\).

.. As  $\frac{27}{97}$ : 1830: :  $\frac{64}{91}$ :  $\frac{1771}{27}$ =4337£. 155. 6 $\frac{2}{3}$ d. the Value which came into Port-

(14) First 16131 7 = 1613 17.

Then  $\frac{7}{8}$  of  $\frac{3}{5}$  of  $\frac{1}{2}$  of  $\frac{16}{13}$   $\frac{17}{10}$  =  $\frac{3387657}{800}$  =  $\frac{42346.115.5}{10}$ . A had at First.

And 3 of 4 of 3387657 = 10162971 = 2032f. 115. 101d. - 54 fold B.

..  $1613\frac{17}{10}$  3387  $\frac{657}{800}$  =  $12905\frac{3}{800}$  =  $3387\frac{657}{800}$  |  $9817\frac{603}{800}$  Alfo  $\frac{9}{17}$  of  $9517\frac{3}{800}$  =  $8565\frac{93}{800}$  = 9743 £.  $3\frac{1}{4}d.\frac{19}{53}$  Coufin P paid.

(15) First 1 = 12 X, 14 = 17 Z.

Then  $\frac{1}{408} + \frac{17}{408} = \frac{29}{408}$  performed in one Day by X and Z. And  $\frac{1}{12} = \frac{30}{408}$  performed in one Day by all three working together.

 $\frac{34}{408} - \frac{29}{408} = \frac{5}{408}$  done in one Day by Y.

Therefore, as,  $\frac{5}{408}$ : 1 Day :: 1 Work : 408 = 81 3 Days the Answer.

(16) First 16 - 3 = 13 left at 6 Month End.

Then  $\frac{2}{3}$  of  $\frac{13}{16} = \frac{13}{24}$ ; and  $\frac{13}{16} = \frac{312}{24} = \frac{384}{384} = \frac{208}{384} = \frac{104}{324}$ , or ±3 ±348 left.

. As 13 :348 :: 48 or 1 : 1284,18, 51 13 the An-

(17) As 3: 19312::5: 96560 = 32186f. 135. 4d. two Years Rent; which : by 2=16093 £. 6s. 8d. the yearly Income required.

(18) First 880 Guineas=924 [.

Then as = 3; 924: : 20: 18480 = 6160 f. the Answer. : 2200 +6160=8360=4 of his whole Fortune. Now as 4: 8369: : 5: 41800 = 10450f.

(19) Here as the Son was to have twice as much as the Mother, and the Mother twice as much as the Daughter, so we will suppose the Estate to be divided as follows viz. 4+2+1=7 the whole Effate; then as she had both a Son and a Daughter, the Mother must have but 2 of the Estate; whereas had it been only a Daughter, the would have had 2.

Then  $\frac{2}{3} - \frac{1}{7} = \frac{14}{21} - \frac{6}{21} = \frac{8}{21} = 2000 \mathcal{L}$ .  $\therefore$  As  $\frac{8}{21} : \frac{2000}{1} : : \frac{8}{3} : \frac{42000}{24} = 1750 \mathcal{L}$ , the Answer.

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- (20) First Cock runs off 3 Galls. = 3 of the Cistern in a Minute; and 1 Min. = 3.

Then, as  $\frac{5}{4}$ :  $\frac{3}{103}$ : 1:  $\frac{12}{515}$  runs off by both in a Minute.

And  $\frac{3}{103} + \frac{12}{515} = \frac{15}{515} + \frac{12}{515} = \frac{27}{515}$  runs off by both in a Minute.

.. As  $\frac{27}{515}$ : 1:: 1:  $\frac{515}{27} = 19$  Min.  $\frac{44}{9}$  fec. the Answer.

(21) First  $\frac{1}{4} + \frac{1}{3} + \frac{1}{6} = \frac{18}{72} + \frac{24}{72} + \frac{12}{72} = \frac{54}{72} = \frac{3}{4}$ .

Then as  $\frac{3}{4}$ :  $\frac{45}{1}$ ::  $\frac{1}{1}$ :  $\frac{180}{3}$ =60 Crowns the Answer.

(22) First  $\frac{1}{2} + \frac{1}{4} + \frac{1}{6} = \frac{24}{48} + \frac{12}{48} + \frac{3}{48} = \frac{44}{48}$  or  $\frac{11}{72}$  and  $\frac{12}{12} - \frac{11}{13} = \frac{1}{72} = 50$  Cherries.

 $\frac{1}{2}$  = 50×6=300 Apples. = 50×3=150 Pears. = 50×2=100 Plums. 50 Cherries.

#### Answer in all 600 Trees.

(23) First  $1=\frac{4}{4}$ , and  $\frac{1}{2}=\frac{2}{4}$ . Then  $\frac{4}{4}+\frac{4}{4}+\frac{2}{4}+\frac{1}{4}=\frac{1}{4}=99$  by the Question. ... As  $\frac{1}{4}$ : 99::1:  $\frac{3}{9}$  = 36 Scholars.

(24) First  $\frac{1}{2} + \frac{1}{3} + \frac{1}{5} = \frac{15}{30} + \frac{10}{30} + \frac{6}{30} = \frac{31}{30}$ . Then  $\frac{31}{30} + \frac{30}{30} = \frac{61}{30}$ ; and  $74 - \frac{4}{5} = 73\frac{1}{5} = \frac{366}{5} = \frac{2196}{30}$ .  $\therefore \frac{61}{30} : \frac{2195}{30} : : : : : \frac{2196}{61} = 36$  Years, the Answer.

(25) First  $\frac{3}{8}$  of  $\frac{2}{3} = \frac{7}{4}$  B's And  $\frac{3}{10}$  of  $\frac{2}{3} = \frac{1}{8}$  C's  $= \frac{9}{20}$ .

Then  $\frac{2}{3}$   $\frac{9}{60}$   $\frac{13}{60}$   $\frac{91}{420}$  left.

1. \(\frac{1}{7}\) of \(\frac{13}{60} = \frac{13}{420}\) E's first Acquisition.

Also, \(\frac{1}{7}\) of \(\frac{13}{60} = \frac{13}{420}\) E's first Head the first Head

Alfo  $\frac{91}{420}$   $\frac{78}{420}$   $\frac{78}{420}$  D's, thus ended the first Heat. Again  $\frac{1}{4}$  of  $\frac{1}{4}$   $\frac{1}{8}$  B's

Again  $\frac{1}{2}$  of  $\frac{1}{4}$  =  $\frac{1}{8}$  B's Retained  $\frac{1}{5}$  C's Part at the end of the fecond And  $\frac{1}{70} + \frac{1}{16} = \frac{130}{560}$  D's Scuffle.

Allo  $\frac{13}{420} + \frac{1}{16} = \frac{157}{1680}$  Es

Proceeding  $\frac{1}{4}$  of  $\frac{1}{5} = \frac{1}{20}$  A's.  $\frac{1}{3}$  of  $\frac{1}{5} + \frac{1}{8} = \frac{1}{20}$  B's.  $\frac{2}{7}$  of  $\frac{1}{5} + \frac{1}{5} \frac{30}{6} = \frac{171}{500}$  D's.

Then  $\frac{1}{20} + \frac{1}{15} + \frac{2}{35} = \frac{7}{420}$ .  $\frac{1}{5} - \frac{73}{420} = \frac{1}{420}$  and  $\frac{1}{2}$  of  $\frac{1}{840} = \frac{1}{840}$  C's Part of the Smuls. Further  $\frac{1}{20} + \frac{1}{15} = \frac{7}{60}$ , and  $\frac{3}{4}$  of  $\frac{7}{60} = \frac{7}{80}$ , tost by A. and B. Then  $\frac{5}{10}$  of  $\frac{7}{80} + \frac{1}{4}$  of  $\frac{1}{20} = \frac{5}{12} \frac{1}{0}$  A.'s Also  $\frac{5}{10}$  of  $\frac{7}{80} + \frac{1}{4}$  of  $\frac{1}{25}$  of  $\frac{1}{8} = \frac{649}{3840}$  B's Part after the  $=\frac{323}{13440}$  E's last Smus I of 80 + 840  $\begin{array}{c} \frac{1}{8} \text{ of } \frac{7}{80} + \frac{11}{840} & = \frac{14}{14}\frac{417}{13} \text{ of } \frac{7}{80} + \frac{171}{840} & = \frac{14}{4}\frac{417}{80} \text{ D.'s} \\ \frac{1}{8} \text{ of } \frac{7}{80} + \frac{179}{1680} & = \frac{1579}{13440} \text{ E.'s} \end{array}$  Part after the Smufs. Then  $\begin{array}{c} \frac{1}{280} + \frac{1}{15} & = \frac{2863}{880} \text{ A.'s} \\ \text{And } \frac{649}{3840} + \frac{1}{15} & = \frac{6335}{6880} \text{ B.'s} \\ \text{Alfo } \frac{328}{13440} + \frac{1}{15} & = \frac{2638}{26880} \text{ C.'s} \\ \frac{1417}{480} + \frac{1}{15} & = \frac{10294}{26880} \text{ D.'s} \\ \frac{1579}{13440} + \frac{1}{15} & = \frac{4950}{26880} \text{ E.'s} \end{array}$  Share carried off at the laft. So that if the Number of Sugar Plumbs were 26880. 2863 A got 6335 B =26880, the Sum. ·C D 10294 E 4950 Ta) Proin 4117 yalda

#### 47. ADDITION of DECIMALS.

,427

64,075

(2)

or allante

,274

,076

(3)

90	,006 <b>7</b> 107.6 ,64 17,6 ,20764	10,8 10,8 ,0074 104,046842	,64762 ,0706 ,47 ,007
Sum	39,97794	206,998342	968,42
(4)	47,674444 4,026420 32,8666666	(5) 11,4444444 6,1427400 91,7888888 37,67x1111	(6) 14,2764210 7,444444 21,646666 9,277777
8,11	27,964666	293,5239254	31,1474444 83,7927543

(1)

,0476

21,476

## Multiplication of Decimals.

(11)

(13

Pro

(7)	14,247x247x 768,24824624 7,06406406 26,00620620	(8) ,2482462 3,8767672 27,0427694 9,9469469
	815,56364122	40,9127298

## 48. SUBTRACTION of DECIMALS.

(2) 647.

Take	10,764	(2)	,007	64	(3)	69,5
Diff.	165,236		646,992	54	, ,	5,1407
(4) From Take	41,744444 21,946480		24,1466 19,9999	(6)		28262826 942764
Diff.	19,797964		4,1468		×1,93	8986226

### 49. MULTIPLICATION of DECIMALS.

(1)	×76	(2)	27,42 (3,56	(3)	×,2575
Prod	19,30304	ACTION OF	97,6152		2,0721128
(4)	5745 ×,9675	(5) ,4 ×,2	(6) ,047 X,046		(7) ,000476 ×,00078
Prod.	387,7875	,08	,00,2162	,00	0000037128

(8) ,47 × by ,0008=,000376, the Product.

(9) 1,076×1000=1076. (10) ,42768×1000=4276,8.

243 333	8928
24337 28613 2086 476 243 333	3678 5895 3826 8613
	191
96,231	6423
(13) 147,64 (14) 42 ×,7	,64z ,276
Prod. 103,351 255 2984 8528 11,76	
(15) 46,2762 (16) 261	,276 ,47
9)370,2096	8932
Prod. 41,134 2,033	2148 5104
Prod. 124,8	3186
(17) 141,14 (18) 24,1 8,47	607 <i>z</i> ,496
9)98801 9)147	6432
109777 164 564577 2214 11291555 9842	0480 6500 8888
1196,5911	5868
U <sub>2</sub>	

2/20	Munpucano	n of Decimais	
(19)	7,842	(20)	64,842
01) 40 10 110	45,855		583585 4538999 12968555
	• • • • • • • • • • • • • • • • • • •		1809,1141
	a Atras hamada da en esc.		
(21)	46,74	(22)	764,742 ,6074
	32718 28044 9348 18696		3058968 5353194 4588452
0.37	19943958 19943		4645042908 464504 46
	199,63922		64,550746ø
(23)	47,842 3,674	(24)	76,28 8,495
	190570 334988 28585555 142927777		3814x 606544 3051333 61025555
	175,038892 175038 175		648,01574 64801 64
***	175,214106		648,66440
1	and of the Milabert		

(1)

(3)

(5)

(7)

(9)

(11)

# 50. DIVISION of DECIMALS.

	Divid. Quot. 733;5(267		Divid. Quot.
(3) 7,476	5)186,900(25	(4)	,008)6,000(750
(5) 604,25	)246,1476(,40736	(6) 119	)7,268401(,061079
(7) 647)6,	7258(,010395+	(8) 678)	,0008136(,0000012
(9) 1000)	487,67(,48767	(10)	1,0000)4746(,4746
11) 2137,2	8,5488 8,5488	2 40,649)	6109,2674(25, <b>3</b> 86 <b>6</b> 481298
4-10036	5820 4274		129628
	1546 1496		9303
	50		2083
	1305	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	158
	Site.	(d	14

(13)6,84)14,44	(2,11176+(1	4)46,849)16	594,847 (36,172546
----------------	-------------	-------------	--------------------

(20

(1)

(4 (5)

(7

,8

764	289177
804	80836
1204	339874
5204	119317
4164	256196
60	219514
	321187
	400093

Ad to Jah

(20) Divide 4176,4266268 by 37,26974. 37,26974)4176,4266268 A 176426

37,26602)4176,0089842(112,0603+

# 51. REDUCTION of DECIMALS.

Commence and the fact of the Dec main reading

## CASE TO COLUMN TO CASE TO COLUMN TO As a Section 11 Section

(1) Thus 1,0:4=,25; and 1,0:2=,5 also 3,0:4=,75.

(2) Thus  $\frac{5}{24}$ =5,000 · 24=,208 g the Decimal required. (3) First  $\frac{5}{12}$  of  $\frac{3}{4}$ = $\frac{5}{16}$  per Case III. Sect. 41. Then 5=5,0000 : 16=,3125 the Decimal required.

A tole agenden A

(4) Thus  $\frac{4}{7} = 4$ ,  $0 \div 7 = 7$ , 57142857 the Decimal required. (5) Thus  $\frac{2}{3} = 2$ ,  $0 \div 3 = 7$ , 8 the Decimal required. (6) First  $\frac{1}{4}$  of  $\frac{1}{2}$  of  $\frac{7}{8} = \frac{21}{64}$ : Then 21 = 21,000000 : 64=,328125, the Decimal req.

(7) First 1 of 15 = 5 Then, 5,00000 - 48=, 10416, the Decimal req.

#### (22) First e best : class : II. lo : ried a shiff (22)

(8) By Rule 1st, thus 17s. 6\frac{3}{4}d.=848 qrs.

And 1\int\_{.=960} ditto. Then \frac{843}{560} or 843,0 \div 960 = ,878125 the Decimal required.

By Rule 3d thus, By Rule 2d thus; 4)3,00 17s. 63d. 5 0.12)6,75 27+1=28 28 2,0)17,5625 ,878125 .878

(27)

Anf

(29)

A

134

F

(9) First 6s. 9d. =  $\frac{27}{80}$ £. per Case VIII. Sect. 41.

For 6s. 9d. = 27 Threepences, and 1£.=80 ditto.

Then 80)27,0(,3375 the Decimal required.

(10) Thus 27 or 3 = 3,00000 -7 = ,42857 + Answer.

(11) First 14s. 63d.=349 Halfpence, and a Moidore=648 ditto.

Then 648)349,0(,53858+, the Decimal required.
(12) First 18s. 4\frac{1}{2}d.=441 Halfpence, and 1\int.=480 ditto.

Then 480)441,0(,01875, the Decimal required.

(13) First \(\frac{1}{4}\) of a Penny=\(\frac{1}{3\)\frac{2}{20}}\(\frac{1}{2}\). per Case VI. Sect. 38.

Then 320)1,000(,003125, the Decimal required.

(14) First 1 lb.=240 dwts. 240) 11,00(,0458 g, the Dec. req.

(13) First 11b.=256drs, then 256)10,00(,03906+the Dec. (16) First qrs. 141b.=981b. then 112)98,0(.875, the Dec.

(17) A yd.=36 Inches, then \(\frac{6}{36}\) or \(\frac{1}{6}=1\), \(\f

(18) First a League, or 3 Miles=34 fur. then 24 or 1= 1,00+4=,25, Answer.

(19) First 18 gal. 2 qts.=74 qts. and 1 hhd.=252 ditto. Then 252)74,0(,29365+, the Decimal required.

(20) First 3 qts. 1 pt. = 7 pts. and a bar. = 256 pts. Then 256)7,00(,02734+, the Decimal required.

(21) First an Acre= 160 Perches, then 160 or 20=1,00÷ 20=.05, Answer.

(22) First 4 bush. 2 pks.  $\pm 18$  pks. and a chald. = 144 do.  $\frac{18}{144}$  or  $\frac{1}{8} = 1,000 \div 8 = 125$ , Answer.

(23) Thus  $\frac{12}{60}$  or  $\frac{1}{5} = 1.0 \div 5 = .2$ , the Decimal required. (24) First 12 Days=288 hrs. and 365d. 6 h.=8766do.

Then 8766)288,00(,03285+, the Decimal required.

f. CASE III. f.

(25) ,878125 (26) ,3375 ×20

s. 17,562500 s. 6,7500 ×12

d. 6,7500 d. 9,00

4

Answer, 6s. 9d.

Anf. 17s. 61d.

Anf.6Fur.8,64 Poles.

<b>(</b> 3 <i>5</i> <b>)</b>	Hhd. ,29265 ×63	Bar. (36) ,875 ×32	(37) Acre.
Galls.	18,5 nearly	28,000	,20
Anfwe	r 18 Galls. A	infiv. 28 Galls.	8,00 Antiger 8 Pol

Chaldrons. Days. (38) (39) ,4765 ,125 ×36 Bufh, 4,500 Hrs. 11,4360 Pks. Min. 26,1600 2,0 Anf. 4 Bufh. 2 Pks. Sec. 9,60 60 Thirds 36,00

Answer, 11 Hrs. 26 Min. 9 Sec. 36 Th.

(3)

(4)

# 52. EXTRACTION of the SQUARE ROOT.

(1) 
$$74770609(8647 \text{ the Root.} 64$$

166)1077

996=166×6

1724)8106

6896=1724×4

Proof thus, 8647×8647=74770609

121009=17287×7

natel (in still have be

(2) 60516(246the Root required.

4 44)205 176

486)2916

(3) 7558)37,5099, or rather 87,51 + the Root.

167) 1258

1745)8900

175009)1750000

1750189)17491900

Rem. 1740199

(4) 39342864(6272,389+the Root.

122)334

1247)9028

12542)29964

125443)488000

1254468)11167100

12544769)113135600

Rem. 23 2679

22	28	F.	rtrasti	on of	the	Square	D .	Service of the servic
7	- 0	٠	uracu	on of	tne	Square	Koot	

1806)10966	
181207)1307940	
1812142)3949152	\$\iong\(\partial\)
18121441)32486890	W
181214427)1436544900	o poor tuitos
1812144349)16804391100	888 (40)
18121443582)49509195900	17457000 1 218
Rem. 13266308736	
(6) ,000729(,027 the Root.	(7) 2)1,41421+the R
47)329	24)100
326 E30 (12) 31 3	281)400
(8) 2,27109570(1,50701 +	2824)11900
25)127	28282)60400
3007)21095	282841)383600
301401)467000	Rem. 100759
Rem. 165599	2002.678.1.(302.7201
(9) 36,00000625(6,0000	The state of the s
120000005(62500000	

(1) (2) (3) (4) (5) (6) (7)

(1) (2)

(3) (4)

(5) (6)

(7) 1 Co Th cb, (8) Fi

v r

(1) Thus  $\sqrt{\frac{25}{81}} = \frac{5}{9}$ , the Root required.

(2) Thus  $\sqrt{\frac{225}{324}} = \frac{15}{18}$ , or,  $\frac{5}{6}$ , the Root.

(3) First  $10\frac{39}{49} = \frac{529}{49}$ . Then  $\sqrt{\frac{529}{49}} = \frac{23}{7}$ , or  $3\frac{2}{7}$  the Root. (4) First  $27\frac{9}{16} = \frac{44}{16}$ . Then  $\sqrt{\frac{44}{16}} = \frac{21}{4}$  or  $5\frac{1}{4}$  the Root.

Then v8,4285714 = 2,9032, (5) First 83 = 8,4285714. the Root.

(6) First \$ 97 = 8831360946. Then v8831360946 =

,93975+the Root. (7) First 7614 = 76,8235294. Then 176,8235294 =

8,7649+the Root.

54. The USE of the SQUARE ROOT.
(1) First 9×4=36. Then  $\sqrt{3}6=6$ , the mean Proportion, For as 4:6:6:9.

(2) First 36×16=579. Then 1576=24 the mean Pro-For as 16: 24 :: 24: 36. portion.

(3) Thus,  $\sqrt{4276}$ , 5=65, 395+

(4) First 9A. 2r. 15p.=1535 Perches. And 5,5×5,5= 30,25 Yards in I Square Perch.

: 1535 × 30, 25=46433,75 Yards the Superficial Cont. Then v 46433,75 = 215,484918 Yards+=215 Yarls 1 Foot 3,467 inc. the Side required.

v160=12,649+, the Side required. (5) Thus

(6) First, As, 355: 452:: 4840: 616,2479 Sq. of the Diam.

.. v 616,2479=24,82+ the Diameter required.

(7) First 4840×2=9680 Yards. Content of the two Acres.

Then as 355: 452:: 9680 12324 Yards=2ab.

.. V 12324=111=ab.

Therefore 111 +2=55\frac{1}{2} yards = cb, the Length of the Cord req.

(8) First 140,5×140,5=19740,25 2A C.

And 55,5×55,5=3080.252 AB

2B C=16660

" v 16660=129,07 yds,=B C, the Height required.





(9) First 40× 0=1600=2 CE, or 2D E.

And 33×33=1089=2A C.

 $V_{511} = 22,6 = A E$ 

Again 21 × 21=441= 2B D.

Then 1600-441=1159=2EB.

·· 1159=3404=B.

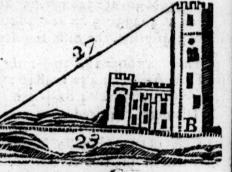
Therefore 226 + 34.04 = 59.64 + Ft. = AE + EB= AB, the Answer.

(10) First 27+27=729
<sup>2</sup>AC.

And 23×23=529

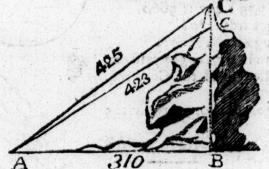
<sup>2</sup>AB. <sup>2</sup>BC <sup>200</sup>

.. \( \frac{200}{14}, 142 \)
\( \frac{1}{4}, \)
or 14 yds. 5,112
\( \frac{1}{4} \)
Inches = B C. the
Height required.



(1

(1



(11) First 425×425=180625=2AC. And 310×310= 96100=2 AB.

Diff. 84525=2BC.

.. V 84525=290,72183=BC, Height of the Light-house and Rock.

Again 423×423=178929=2 Ac.

- 06100=2 AB.

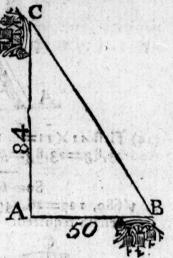
Diff. 82829=2 B C.

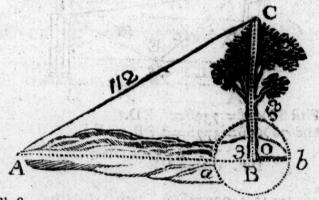
.. V 82829=287,80027=Bc. Height of the Rock. Therefore 290,73183—287,80027=2,93156 Fathoms. .: Or 17 Ft. 7 In.=Cc. the Height of the Light-house.

(12) First 50×50=2500=2AB. And 84 × 84 = 7056= AC.

Sum 9556= BC.

9556 = 97.75 or 97% Leagues=BC, the Distance required.

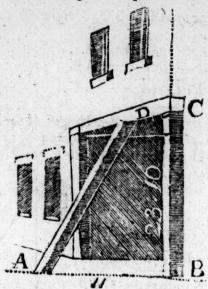




(13) First 112×112=12544= A C. And 53 × 53 = 2809= BC.

Diff. 9735=2 A B.

..  $\sqrt{9735} = 98,6 = \overline{AB}$ . Now ab = 30. Which  $\div 2 = 15$  = a B. And  $98,6 - 15 = 83\frac{2}{3} = Aa$ , Breadth of the Mt. req. X 2.



Now

And Now And

:. 1

wor. Feet

The

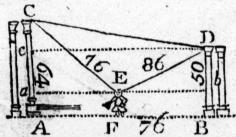
Alf

Th

So

(14) First 11×11= 121 = AB. And 23,8 = 23,8 = 568,027= BC.

Sum 689,027=2AC.
.. 1/689, 127=26,249, or 26 Feet 29 Inches=AC, the Length required.



(15) First 86×86=7396=2 ED. And 76×76=5776=2 FB. or E b.

Diff. 1620=2Db.

..  $\sqrt{1620} = 40,24922 = D b$ . Also 50-40,24922=9,75078=EF. Height of Stature. Likewise 64-9,75078=54,24922=AC-A a=aC. Again 97×97 =9409 = EC. And 54,24922×54,24922= 2942,97787=aC.

Diff. 6466,02213=a2E, or AF.

.. 16466,02213=80,41157=a E, or AF.

Now 76+80,41157=15,641157=AB, or cD, Distance of the Columns.

And 64-50=14=c C diff. of their Heights.

Now 156,41157×156,41=24464,5792=2 CD.

And 14×14= 196 = 2 Cc.

Sum 24660, 5792=2 CD.

.. √24668,5792=157,03+=C D, Distance of the Top of the Columns.

But if the Statue be higher than the Columns, then by working as before we shall find the Statue to be 40,24922 Feet higher than the lower Column.



Therefore 50+40,24922=90,24922=EF, Height of the Statue.

Also, 90,2492—64=26,24922 higher than the highest Column.

Then  $97 \times 97 = 9409 = {}^{2}CE$ And  $26,24922 \times 26,24922 = 689,02135$ 

Diff. 8719,97845

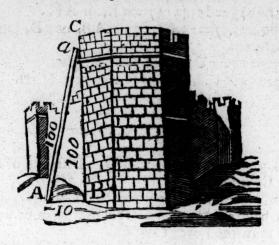
. v8719,97845=93,3808 AF.

So that 76+93,8808=169,3808=AF+FB Distance of the Columns.

Again  $1693,808 \times 169,3808 = 28689,8554064 = {}^{2}c$  D. And  $14 \times 14 = 196 = {}^{2}c$  C.

Sum 28885,85540864=2c D.

· v 28885,85540864 = 169,95839 Ft. = CD, Distance required.



(16) First  $100 \times 100 = 10000 = {}^{2}A a$ . And  $10 \times 10 = 100 = {}^{2}A B$ ,

Diff. 9900=2Ba.

Then v 9900=99,49874=Ba.

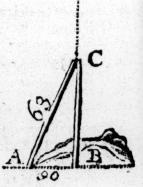
.. 100—99,49874=,50125=aC, which is 6 Inches nearly. Q. E. F.

(17) First 63×63=3969=2°AC, or CD.
And 30×30= 900=°AB.

Diff. 3069=2BC.

Then v 3069=55,3985 yds.=B C, Piece standing.

.. 63+55,3985=118,3985 yds. or 118 Yds. 1 Foot 2½ Inches=Ba, Height of the Pole.



a

(18) Thus v23716=154 Men, the Answer.

```
The Extraction of the Cube Root.
    55. The EXTRACTION of the CUBE ROOT.
             -21024576(276
(1)
    377=1200)13024
              8400=3rre Here r=20, and e=7.
               343=eee
             11683 Subtrahend.
3rr=218700)1341576 Dividend.
               1312200=3rre Here r=270, and e=6.
                    216=eee )
               1341576 Subtrahend.
               92398647(452,08+the Root.
(2)
               64
     3rr=4800)28398 Dividend.
               24000=3rre \ Here r=40, and e=5.
                  125=eee · )
               127125 Subtrahend.
 3rr=607500)1273647 Dividend.
              1215000=3rre]

\begin{array}{c}
5400 = 3ree \\
8 = eee
\end{array}

Here r = 450, and e = 2.
              1220408
3rr=612910000)53239000000 Dividend.
              49032960000=3rre Here r=45200, and
                   8678400=3ree
                       512=eee
              49041638912 Subtrahend.
               4197361088 Rem.
```

Now  $452.8 \times 452.08 \times 451.08 + 4197361088 = 92398647$ ,

2716243264)1395,24+ the Root.

Here r=10, and e=3.

the Proof.

3rr=300)1710 Dividend.

1197 Subtrahend.

(3)

```
The Extraction of the Cube Root.
236
        3rr=50700)519243 Dividend.
                                       Here r = 130,
                                          and e=9.
                  488619 Subtrahend.
     3rr=5796300)30624264 Dividend.
                  29085875 Subtrahend.
   3rr=583807500)1538389000 Dividend.
                   1167782408
3rr=58397491200)370606592000 Dividend.
                                           Here r=
                 350400015576 Subtrahend. ) and e=6.
                  20206576424 Remains.
           91)4,497+ the Root.
    (4)
  3rr=4800)27.000 Dividend.
                                Here r=40, and e=4.
              21184 Subtrahend.
  3rr=580800)5816000 Dividend.
                                  Here r=440, and
               5334849 Subtrahend.
3rr=60480300)481151000 Dividend.
                                       Here r=4490,
                                         and e=7.
               424622473 Subtrahend.
                57128527 Remains.
(5)
              67527834239)4072,18+the Root.
  3rr=480000)3527834 Dividend.
                                     Here r=40, and
               3419143 Subtrahend.
3rr=49694700)108691230 Dividend.
                                       4070, and,
                99438248 Subtrahend. \ e=2.
```

317=

(6

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The Extraction of the Cube Root.
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237

```
317=4974355200)9252991000 Divid. Here r=40720,
                                    and e=1.
                4974477361 Subtr. S
grr=497459952300)4278513639000 Divid. ) Here r=
                  3979757803232 Subtr.
                   298755835768 Remains.
               4764,750)16,827+the Root.
 (6)
      3rr=300)3764 Dividend.
                                 Here i=10, & e=6.
               3096 Subtrahend.
      3rr=76800)668750 Dividend.
                                    Here r=160,
                                        and e=8.
                 645632 Subtrahend.
      3rr=8467200)23118000 Dividend.
                    16954568 Subtrahend.
   3rr=848737200)6163432000 Dividend.
                                         2 Herer=
                  5943633293 Subtrahend. \ and e=7
                    219798717
      (7)
               36155,027576(33,0365
       3rr=2700)9155
                 8937
    3rr=32670000)218027576 Dividend,
                                         Here r =
                                          3300, and
                   196376616 Subtrahend.
317=3278890800)21650960000 Dividend.
                                         Here r =
                                         33060, and
                 19676915496 Subtrahend. \ e=6.
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238 The Extraction of the Cube Root.
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177=

(1

3

3rr:

3rr

3+7

377

31

```
3rr=328008106800)1974044504000 Divid. 7 Here ,=
                                           330660, &
                   1640065333625 Subtr.
                   333979170375 Remains.
    (8)
            67667,921875(40,75 the Root.
3rr=480000)3667,921 Dividend.
                                   Here r = 408, and
             3419143 Subtrahend.
                                     e = 7.
3rr=49694700)248778875 Dividend.
                                          and e=3.
               242778875 Subtrahend.
              219565329(603,1+the Root.
    (9)
  3rr=1080000)3365329 Dividend.
                                     Here r = 600.
                                        and e=3.
               3256227 Subtrahend. S
3rr=109082700)109102000 Divid. Here r=6030, and
               109100791 Subtr. 5
                     1209 Remains.
        3105926,917)145,9-the Root,
(10)
3rr=300)2105 Dividend.
                            Here r=10, and e=4.
         1744 Subtrahend.
3rr=58800)361926 Dividend.
                               Here r= 140, and e=5.
```

304625 Subtrahend.

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239
11=6307500) 57301917 Dividend, Here r= 1450, and
            57120579 Subtra.
               181338 Remains.
 (11) ,000421875),075 the Root.
 3rr=14700)78875 Dividend.
                               Here r=70, and e=5.
           78875 Subtrahend.
           28022810,390625)303,7413+the Root.
 (12)
3rr=270000)1022810 Dividend. 7 Here r=300,
                                  and e=3.
           818127 Subtrahend.
3rr =27542700)204683390 Dividend.
                                     Here r =
                                     3030, and
```

193244653 Subtrahend. 3rr=2767010700)11438737625 Divid. e = 7.Here r = 30370, and 11082607350 Subtr.

3rr=276773962800)36923700100 Div. Here r =303740,& 276774874021 Subt.

3rr=27677578524300)92462126979000 Div. ) Here r= 830328175829997 Su. ) and e=2. 9429309396003 Remains.

(13) · First v 4857532416=69696. Then v 69696=264 the biquadatic Roct required.

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- (14) First  $\sqrt[2]{49656} = 216$ , then  $\sqrt[3]{216} = 6$ , the square cubed Root required.
- (15) First  $\sqrt[3]{43046721} = 6561$ , again  $\sqrt[3]{6561} = 81$ , also  $\sqrt[3]{81} = 9$  the Root.
- (16) First  $\sqrt{387420489} = 729$ . Then  $\sqrt[3]{729} = 9$ , the Roots at the 9th Power.
- 56. TO EXTRACT THE CUBE ROOT OF VULGAR FRACTIONS.
- (1) First  $\frac{324}{1500} = \frac{27}{125}$ , then  $\sqrt{\frac{27}{26}} = \frac{3}{5}$ , the Root req.

(2) First  $\frac{352}{1783} = \frac{27}{27}$ , then  $\sqrt{\frac{8}{27}} = \frac{3}{2}$ , the Root.

- (3) First  $5 \times 125 + 104 = 729$ , then  $\sqrt[7]{\frac{29}{125}} = \frac{9}{5}$ , or  $1\frac{4}{5}$ , Root.
- (4) First  $405 \times 125 + 28 = 50653$ , then  $\sqrt{50652} = \frac{37}{5}$   $7\frac{2}{5}$ , the Root.
- (5) First 5\frac{3}{5}=5,6, then \( \sigma 5,600=1,775+\text{the Root.} \)
- (6) First 7 = 7,7142857, then  $\sqrt{7}$ ,7142857=1,975, the Root required.

### 57. The USE of the CUBE ROOT.

- (1) First  $\sqrt[3]{21952}=28$  Side of the Cube. Then  $28\times28=784$ , the Content required.
- (2) First  $125 \times 125 \times 125$ And  $25 \times 25 \times 25$ Also  $15 \times 15 \times 15$   $\times$   $\sqrt{5859375} = 180,28$  Keel. And  $\sqrt{46875} = 36,05$  Midship-beam. Also  $\sqrt{10125} = 21,6$  Depth in the Hold.
- (3) First  $125 \times 125 \times 125$ And  $25 \times 25 \times 25$ Also  $15 \times 15 \times 15$ Which Numbers extracted will give 99,21; 19,84 and 11,905 the Dimer signs required.

- (4) First 75×75×75=421875, and 100×100×100=
  - Then, as 421875 C. K.: 300 Tons, :: 1000000 C. K. 711, 7 Tons, or 711 Tons, 2 cwt. 24, 64 lb. the Burthen required.
- (5) First  $4\times4\times4=64$ . Cube of the Diameter. Then, as 18lb.: 64 inc. :: 114lb.: 405, 3 inc. Cube of the Diameter.
  - .. v405,3=7,4+, the Diameter required.
- (6) First 11,5 $\times$ 11,5 $\times$ 11,5=1520,875, and 20,83 $\times$ 20,83  $\times$ 20,83=9037, 905787.

Then, as 1520,875: 1000 lb.: 9037,905787: 5942,5697lb.+, the Weight required.

- (7) First 189:7=27, whose Cube Root is 3.

  Then 3×7=21, the lesser Mean, and 21×3=63 the greater mean.

  For, as 7: 21:: 63: 189, the Proof.
- (8) First 256:4=64, then  $\sqrt{64}$ =4, which × by 4=16, the lesser Mean, and 16×4=64, the greater. For, as 4:16::64:256, the Proof.

#### TO EXTRACT THE FIRST SURSOLID ROOT.

#### RULE.

1. Having pointed the given Resolvend into Periods of sive Figues, seek such a Sursolid Number in the Table, or otherwise, as comes nearest to the first Period of the Resolvend, whether greater or less; and call the respective Root, either more than just, or less than just, as it falls out; annexing so many Cyphers to it, as there are remaining Periods of whole Numbers in the Resolvend.

2. Find the Difference between the Resolvend and the Sursolid Number, so taken, by subtracting the leffer from

the greater.

3. Find the Cube of the aforesaid Sursolid Root, with its annexed Cyphers, which also may be done by the Table,

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and multiply that Cube into five, the Index of the Surfolid, and divide the difference between the Resolvend and the Sursolid Number by that Product; by which it will be depressed to a Square, and when pointed into Periods of two

Figures each, call it the new Refolvend.

4. Make the first Root without Cyphers a Divisor, enquiring how often it may be found in the first Period of the new Resolvend; with this Consideration, if the Root now a Divisor, be less than just, annex twice the Quotient Figure to it; but if more than just, subtract twice the Quotient Figure from a Cypher, either annexed or supposed to be annexed, to that Divisor or Root, multiplying it so increased or diminished, with the said Quotient Figure: setting down the Units Place of the Product under the pointed Figures of that Period, subtracting it as in Division.

#### TABLE.

	1	1			6		1 0	(1) 根据(2) (2)
1		3	4	5	O	7	0	9
1	1123	43	1024	3125	7776	16807	8 32768	59040

#### EXAMPLES.

(1) Extract the Surfolid Root of 12309502009375, the Refolvend pointed.

The nearest Surfolid Number to 1230, the first Period of the Resolvend, is 1024, whose Root is 4 (by the Table) less than just.

Therefore 12309502009375

2069102009375 their Difference.

Now as there are two Periods remaining in the Resolvend, place two o's to 4, the Root of the first Period.

Next the Cube of 400=64000000.

And 6400000 × 5=320000000 the Divisor. Then 320000000)2069502009375(6497, &c. First Root = 400+2 × 10 = 20

First Divisor = 420)6467( 15 last Root. +20×2×5 = 30 42 400 First.

> 450)2267(415 Root (true) required. 2250

Rem. 17 to be rejected.

Now  $415 \times 415 \times 415 \times 415 \times 415 = 12309502009375$ , the Proof.

(2) Extract the Surfolid Root of 2327134559873.

Now the nearest Surfolid Number to 232 is 243(per Term) whose Root is 3, being more than just.

Rem. 102165440127 for a Dividend.

300 Cubed=27000000, which  $\times 5$ =135000000 Divisor. Then 135000000)102165440127(756,7810 new Resolvend. First Root.

 $-2 \times 2 = -4$ 

300 first Root.

1 Divisor = 296)756,7810( 2,566 last ditto, too much. -4-2×,5=-5,0 592

2 Divisor = 291,0)164,78 ( little by 2 in the  $-1-2\times00=-1,12145,50$  lowest Figure.

3 Divisor = 289.88)19,2810( &c. &c. To EXTRACT THE ROOT OF THE SECOND SURSO.
LID, OR SEVENTH POWER.

Fir

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#### RULE.

Having pointed the Resolvend into Periods of seven Figures, seek out such a Number by the Table, as comes nearest to the first Period of the Resolvend, whether greater or lesser, calling its Root more than just, or less than just, annexing a proper Number of Cyphers.

2. Find the difference between the Resolvend and that Number of the seventh Power by subtracting the lesser from the greater.

3. Find the Surfolid or fifth Power of that Root, with its annexed Cyphers, by that Table; and multiply that Surfolid Number into seven, the Index of the Resolvend.

4. Make that Product a Divisor, by which the aforesaid Difference must be divided; so that it may be depressed to a Square, and pointed as such.

5. Make the first Root without a Cypher, a Divisor, working with it and the new Resolvend, as in Sursolid, only here you must increase or diminish the Divisor with three quotient Figures.

#### TABLE.

# 1 28 2 187 16384 78125 279936 823543 0097152 4782660

#### EXAMPLE.

What is the fecond Surfolid Root of 382986553955078125 Refolvend pointed.

-2187 the nearest of the seventh Power.

164286553955078125 their Difference.

The first Root is 300, being less than just, and the fish power of 300=243000000000, which being multiplied by 7=17010000000000 for a Divisor, by which the aforesaid Difference must be divided, which contracted may stand thus (1701) 16428655(9653,23, &c.

First Root = 300  

$$3 \times 20 = +60$$
  
1 Divisor = 360)9658(25  
 $60+3\times,05=+7572$  325 the true Root.

2 Divisor = 435)2478

Rem. 283 to be rejected.

### 16. THE RULE OF THREE IN DECIMALS.

(1) First 6s. 3d.=,3125f. and 4=4,75 Yards. 48= 48,5 Yards. Then, as 4.75: 3125:: 48,5: 3,19078 or £.33,94 the Answer.

(2) First 2 1/2 lb .= 2,5. And 1 f. 55 = 1,25. Also 142=

Then, as 2,5lb.: 1,25f. :: 14,75lb.: 7,375=7f. 7s. 6d. The Answer.

(3) First 11h.=,00892858C. 112d.=,048958 xf. And 4hhds. each 4C. grs. 24lb .= 4,625 × 4=18,5 C. Then, as,00892857:,04895836.::18,5C.:101,4417£. =101f. 8s. 10d. the Answer.

(4) First 4 Chests each, 2C. 3985. 14lb = 2,875 C. X 4= 11,5C. And goof. 10s = 906,5f.

Then, as 11,5: 906,5::,00892857: 7038=14s. 3d.,6. the Answer.

errope of a to Hull tree real - by the r. (5) side of grant of Cont. 3, 10 : 12: 12: 13 g the relief

8. J. C. C. C. C. S. med this said the See-Cafe 4, p. 166 116 G.

Last, Ora W

. sowless add to Ball & Steel

3)1044 (14) Now, 28'8 year era cather bleffer Manher

Answer 348 Miles. - De 14 Answer 11 and are Atom to deed Smare of their Son.

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(6) First, from 4 Tuns, 201½ gal. take 24½ gal. remains 4
Tuns, 177 gal. or 1185 gal.

And f. 240 16s. 6d .= 240,825f.

As, 1185: 240,825:: 1:,20322, or 4s. \$\frac{1}{4}d. nearly.

(7) First 4  $\frac{74}{125}$  = 4,592, which  $\div$  12 = ,382%, ft. this added to 10 ft. = 10,382% ft. = to 6,5 Cubits.

Then, as 6,5 cub.: 10,382%:: 1 cub. (1,597%=1 ft. 7,168 Inches. the Answer.

(8) First 78,4:8=9,8, the second Number. Then, as 5:9,8,::815,68, the fourth Number.

.. 15,68-9,8=5,88, the Answer.

(9) First  $13\frac{1}{3} = 13.3$ . And  $13.3 \times 282 = 3760$  Cubic Inches, the Content of the Cask.

Then  $3760 \times ,52835 = 1986,596$  oz. Weight of the Oil. Which  $\div 16 = 124,16225$  lb. Also  $7\frac{1}{2} = 7,5$  lb. Weight of 1 gall.

Therefore, as 7,5lb. : i gall. :: 124,16225lb. : 16,555=

16 gall. 2 qts. 4pts. the Aufwer.

(10) First 4,63-1,5688=3,0612 oz Difference. And a folid Foot and Half,=1728+864=2592 folid in. Then, as 1 inc.: 3,0612 oz.:: 2592 inc.: 7934,6304 oz. =4,4278 cwt. or 4 cwt. 1 qr. 19lb. 14 oz. 9,88 drs. Answer.

(11) Now, as 5:8:: 75: 120, the greater Number. Then 75+120=195, their Sum.

And 120-75=45, their Difference.

Also  $195 \times 45 = 8755$ , Prod. of their Sum and Diff.  $120 \times 120 = 14400$ , Square of the gr. and  $75 \times 75 = 5626$  of the lesser.

14400-5625=8775, Diff. of those Squares.

14400+5625=20025, Sum of ditto.

75-120=,625 Quot. of the gr. divided by the leffer.

1,6,×1,6,=2,56, Square of the greater Quot.,625×,625=-,390625, Square of the leffer Quot.

Answ. 2,950625 fum of those Squares.

(12) Now, as 8:7:: 224: 196, the leffer Number. Then 224+196=420, their Sum. And 420×420=176400, Square of their Sum. Also 240-196=28, Diff.

28×28=784. Square of that Diff.

224-196=1,148258, Quot. of greater - lesser. 196-224=,475, Quot. of the lesser - greater.

 $x,142856 \times x,142856 = 1,30612 +$  Square of those ,875 \times,875 = ,765625 Quotes.

420×28+28=11788, Prod. of their Sum and Difference, and the Diff. added.

Laftly, 11788×11788=138956944, Square of the Sum of their Diff. added to the Prod. of their Sum and Diff.

(13) He that rows towards And he that rows from London goes \ 7.5 } per Ho.

Sum to

. 34:10=3,4 Hours before they will meet.

Then, as t h.: 2,5 m. :: 3,4 h. : 8,5, or 8½ Miles from London.

And 34-8=25 Miles from Chertfey, the Answer.

(14) First 13,5-7,5=6 Inches, Diff.

Then, as 4:9::6:13,5lb. the Answer.

(15) First 18200 f. at 3 per Cent.=546 f. spent on the Funeral and Monument.

Then 18200—546=17654£. left.

Again 17654£. at 9£. per Cent.=1588,86 gave to his Coufins.

Then 17654—1588,86=16065,14£. what he had then left.

Again = of 16065,14=4590,04£. paid for the feat.

Then 16065,14-4590,04=11475,1 left.

Again 11476,1 ÷8=1434,3875 paid for Horses. Then 11475,1—1434,3875=10040,7125 left.

Also 10040,7125—550£ =9490,7125 lest, after he had spent 550£. on his Mistress.

Now, as 12: 2000::29: 3166, & f. spent in riotous Living, ... 9490,7125—3166, &=6324,0458 & or 6324 f. 11d. the Answer.

(16) First 6×6=36. And 3×3=9 Square of their Distances.

Then, Receip. as 36: 1:: 9:4, fo that A's Place is four Times as hot as B'e.

The Rule of Three in Decimals. Then, Receip, as (24) .. v328050000000000=57275649 Miles, the Anfw. Squares of their Distances; the Cyphers being omitted. (18) First 81+81=6561. And 424×424=179776 Squares of their Distances; the Cyphers being omitted. Then Receip. as 179776: 1:: 6561:27,4; fo that the Sun's Influence on the Earth to that on the Planet 16,0 Jupiter, is as 27,4, to 1. (19) First 32×32=1024. And 777×777=603719, the Squares of the Distances, Cyphers omitted. Then, Receip. as 603729 Sat. : 1 ::1024 : 589,584 Merc. nearly. .. The Solar Influence on Mercury to that of Saturn, is as 589,584 to 1, nearly. (20) First 115 X 115=13225 Square. (25) As 13225 : 1 :: 2 : 13225 Degrees hotter. (21) The Square Roots of the Distances being as the Times, viz. as the V1: V2:: is the Time of falling through the whole required Height. Now the VI=1, and V2=1,4142, from which take 1. Remains , 4142. . As, 4142: 1,4142:: 1: 3,414 Secs. the Descent; the Square of which is 11,6574. Then as 21: 16,08g:: 11,6574: 187,48 ft. the Tower's Height.

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(22) First 7970×7970×7970=506261573000. And 2170×2170×2170=1021831313000.

Then, as 1021831313000: 506261573000:: 1:49,5445, Times bigger than the Moon.

.. As 132,5: 100:: 49,5445: 40,117, Q. E. F.

That is, the Earth contains 40,117 Times more Matter than the Moon.

(23) First 81000000 + 2400000 = 81240000, Sun from a full Moon.

And 81000000-240000=80760000, Sun from a new Moon. 5 8124×8124=65999376 ? Squares of their Distances Receip. A: 65221776: 1::65999376:,9882.

So that the Proportion of Light, and Heat, a new Moon has to that of a full one, is

As 1 to ,9882, or as 458329 to 452929 in whole Numbers

First 11 X-11=121, and the Square of 1 is 1. (24) Then, As 1: 16,083 :: 121: 1946,082, Q. E. F.

Or 
$$\begin{bmatrix}
1 = 16,083 \\
3 = 48,25 \\
5 = 80,416 \\
7 = 112,583 \\
9 = 144,75
\end{bmatrix}$$
in the 
$$\begin{bmatrix}
16,083 \times \\
16,083 \times \\
15 = 241,25 \\
17 = 273,416 \\
19 = 305,583 \\
21 = 337,75
\end{bmatrix}$$
in the 
$$\begin{bmatrix}
16,083 \times \\
16,083 \times$$

Answ. 1946,08 g as before.

(25) First 10×10=100, and 6×6=36, Square of their Descents.

Then, as 1: 16,08 g :: { 100: 1608, 3 } their Depths

Answer, 1029, 3

(26) First 19,5×19,5=380,25 fq. of the Descent. Then, As 21: 16,08 g :: 380,25: 6115, 6875 Feet. Which +6=1019 faths. 1 ft. 81 inc. Q. F. F.

(27) Thus, As, 16,08 g: 21:: 400: 24, 8702.

√24,87002=4,987+, or 5 fecs. nearly the Answ.

(28) The Semi-diameter of the Earth=3980 Miles, or 21014400 ft.

Then, As 16,083: 12:: 21014400: 1306594,82.

. v1306594,82=1135,554 fec. = 18 Min. 55" 33" Q. E. F.

### 57. The DOUBLE RULE of THREE in DECIMALS.

(1) First, As 1,1f.: 12 Per. :: 1,6f. : 17,45 Persons. Then Receip. As 25,2f.: 27,45 :: 18,9f.: 23 Perfons, nearly, the Answer.

(2) As 19 lb.: 42,5 lb.:: 13 lb.: 2,908 lb. Also 2,908:6::10:20,6334lb. worth 63 lb. at 3d. per 16,=63×5=315d. or 1,3125f.

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250 The Double Rule of Three in Decimals.
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Then, As 20,634: 1,3125f. :: 112lb. : 7,12437£ = 7f. 2s. 53d. 9 (nearly) the Answer. Then 100×1×38,5 £.P yr. I. (3) 100 . 1 . 3.5 3,5×1,25 1,25 38,5 =880 (. the Answer. (4) First from Decemb. 11th. to May 10th .= 150 Days. And from Sept. 3d. to Christmas-Day=113. Alfo 91 Guin .= 95,55 (. and 100 Mar. = 66,6 f. Then, As 95,55f. : 150 Days, :: 66,6f. 215 Days. .: 215-113=102 Days Receip. As 66,6: 102: 40f. 169,13 Days, or rather 170 Days, the Answer. (5) Days. f 7 = ,083333 = A.B.C. 7 Will Work. Day T=,0714285 =B.C.D.  $\frac{1}{15}$ =,0666666 =A.C D. the whole 18 -,0555555 = A.B.D. J Work. All working three Days ,276984 Part of the Work. will do Then, As 276984: 3:: 1: 10,8309505 Days, all working. 14=B. C. D. -10,83095 A. B. C. D. As 3,16905 : 10,8395 :: 14 : 47,848 Days by A. 15=A. C. D. -10,83095 As 4,16905 : 10,8895 :: 15 : 38,969 Days by B. 18=A. B. D. -10,83095 As 7,16905: 10,8395:: 18: 27,194 Days by C. 12=A. B. C. -10,83025

As 1,16905: 10,8395:: 11: 111,1766 Days by D.

16) First 34"=,009444 ho. and 5 Rods,=,015625 Miles. Then, as I ho. : 12 Miles, :: ,009444 ho. : ,113328m. .. ,113328+,015625=,128953 m. or 680,9 ft. the Hare had started.

Now 20-12=8, Dog gained in running 20.

Again, As 8: 20:: ,12895: 2,57906 fur = 17021 ft. run by the Greyhound.

. As 8: 1 ho.::,128953m. : ,016119 ho.=58",0284. run by the Greyhound.

#### VIBRATION of PENDULUMS.

900: 156,8. (7) Receip. As 3600: 39,2 ::

Answer, Inches 147

(8) Receip. As 39,2: 3600:: \ \ \ 6: 23520.

.. V11760=108,444, and V23520=153,362. Then  $153,362\times60 = 9201,72$ And  $108,444 \times 60 = 6506,64$ 

Answer 2695,08 the Difference.

(9) A Pendulum which vibrates 60 Times in a Minute, will vibrate 60×60=3600 Times in an Hour; the Square of which = 12960000, and the Square of 30=900; also of 100=10000. Then Receip.

900: 564480 12960000 : 39,2 inc. ::-10000: 50803,2

12)513676,8 Inches.

Answer Diff. 42806,4 Feet.

(10) First a Pendulum which vibrates Thirds, will vibrate 60 Times in a Second.

. As 12: 39,2:: 602 (3600):,0108 inc. the Length of that which vibrates Thirds.

Secondly, a Pendulum which vibrates Seconds, will make 60 Vibrations in a Minute.

.. As 602 (3600) : 39,2 :: 21 : 11760 inc. = 23 Miles, the Length of a Pendulum which vibrates once in a Minute.

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Thirdly, a Pendulum which vibrates Seconds, will make

(60×60)=3600 Vibrations in an Hour.

.. As 36002 (12960000): 39,2 :: 21 : 508032000 inc. =80187 Miles, the Length of the Pendulum, which vibrates once in an Hour.

Lastly, a Pendulum which vibrates Seconds will make (60×60×24)=86400 Vibrations in a Day, or 24 Hrs.

.: As 864002(7464960000): 39,2:: 21 : 292626432000 inc.=46181881333 Miles, the Length of a Pendulum, which vibrates once in a Day.

First 60 X60=3600.

Then, As 36,2 inc. : 3600 fec. :: 18 inc. : 7840 fec.

.. v7840=88,54370, Vibrations in one Minute. Then 60)88,54378(1,475729 Vibrations in a Second. Also 1,475729)8,000000(5,421 fec. in eight Vibrations. Now 5,421 X5,421=29,387.

Then, As 21: 16,083 ft. :: 29,387 : 472,640916 ft. Sound was returning.

Again, As 1150 ft.: 1 fec.:: 472,640916:,41099", Time Sound was returning.

.. 5,421-,411=5,01 Seconds, Time of the Body's Descent.

And 5,01 × 5,01=25,1. Also 25,1 × 16,083=403,69 st. the Depth of the Well.

### 58. FELLOWSHIP.

(1) First, 750+450+300=1500 the whole Stock. And 300f. -1500=,2 the Quotient. Then 

(2) First 
$$\begin{cases} 120 \\ 250 \\ 100 \end{cases}$$
  $\times$   $\begin{cases} 8 \\ 4 \\ 5 \end{cases}$  =  $\begin{cases} 960 \text{ A's} \\ 1000 \text{ B's} \\ 500 \text{ C's} \end{cases}$  Stock and Time.

Sum 2460)184,5(,075 the Quote.

Then 
$$\begin{cases} 960 \\ 1000 \\ 500 \end{cases} \times ,075 = \begin{cases} 72 \\ 75 \\ 37.5 \end{cases} \begin{cases} A's \\ B's \\ C's \end{cases}$$
 Gain.

Proof 184,5 = £.184 10 0

(3) First 229£. 135. 4d.=2296; 55=5,5; 43=4,42857

× ,4=4,x; and 32=36.

Then Nell takes up 3,8, as often as Anne takes up 4,x; then as often as Moll takes up 5,5, Anne takes up 4,42857x; and Nell must take

3,6×4,42857x

-=3,949809.

For, As 4,1: 3,6:: 4,428571: 3,949809.

Hence Moll takes 5,5555555
Anne 4,288571 Ratio of their Shares. And Nell 3,949809 )

Sum 13,933935

. As 13,933935 5,5555555 : 91,569=91 11 44 M. 4,428571: 72,995=72 19 103 A. :229,6£. ::  $\int_{3,949809}^{4.7} : 65,102=65$  2

## 59. SIMPLE INTEREST.

Theorem, I. Ptr = I. the Interest.

(1) Here is given P=260,875, t=5.5 and r=,045. Then per Theo. 260,875×5,5×,045=64,5665625= 64£. 115. 3\frac{1}{4}c.,9, the Interest required.

(2) First, from May 12, 1784, to Nov. 24, 1789, is 5 yrs. 196 ds. or 5,536986 vrs =1, r=,0375, and P=500. Then per Theo. 5,536986×,0375×500=103,8184875

=103£. 16s. 41/1.,48 the Answer. When the Interest is for Days.

(3) Here r=,00012328767, t=,220 and P=370,5. Then per Rule ,00012328767×370,5×220=10,049+ =10£. 114d the Interest required.

(4) First, from July 1, to Feb. 24, following, is 238 Days,

=t, P=600, and r=,00016438356.

Then 00016438356×238×600=23,4739723628=23£. 9s. 54d. the Interest.

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Theorem II. P t r + P = A, the Amount.
(5) Here P=284,5, t=7, and r=,035.
  Then per Theo. 284,5, ×7×,035+284,5=354,2025=
    354£. 4s 1d.,4, the Amount required.
(6) Here P=672,25, t=5,5 and r=,045.
  Then per Theorem, 672,25×5,5×,045+672,25=838,631875=838£. 125. 7½d.,6, the Answer.
(7) Here P=500, t=6,328767, and r=,0475.
  Then per Theorem V1. 328767 × ,0475 × 500+500=
    650,30821625=650f. 6s. 11d. 8+, the Amount.
        Theorem III. \frac{1}{tr} = P, the Principal.
(8) Here I=69,675, t=3, and r=.05.
  Then per Theo. \frac{69,675}{3\times,05} = \frac{69,675}{,15} = 464,5 = 464 £. 10s.
     the Principal.
(9) Here I=64,35, t=5,5, and r=,045.
                              64.3500 = 260 £. the Anf.
                    64,35
  Then per Theo .-
                   5,5×.045
                               ,3475
(1') Here I=67,790625, t=4 and r=.04.
   Then per Theo. 67,790625 67,790625 = 423£. 135.
                    4×,04
                                  ,16
     91/2d. ,75+, the Principal required.
        Theorem IV. \frac{a}{tr+1} = P, the Principal.
(11) Here a=354,2208 g, t=7, and r=,035.
   Then per Theo. 354,2208 g = 334,22083 = 284,5147
                  ,035×7+1
     =284£. 10s. 3\frac{1}{2}d., 112, the Answer.
(12) Here A=500,460418, t=6,418, and r=,05.
   Then per Theo. 500,460418 500,460416
                  6,416×05+1 1,32083
     378,89826+=378f. 175. 112d.,2296, the Answer.
(13) Here A=100, t=7,6027397, and r=,0475.
                            100
     hen per Theo. =
                   7,6027397×,0475+1 1,36113
     73,4675+=73£. 9s. 4d.,2, the Principal.
```

Theorem V.  $\frac{1}{p_r} = t$ , the Time.

(14) Here I=69,675, P=4645, and r=,05. Then per Theo.  $\frac{69,675}{464,5\times,05} = \frac{60,675}{23,225} = 3$  yrs. the Time. required.

(15) Here I=64,45, P=260, and r=,045. Then per Theo.  $\frac{64,35}{260 \times ,045} = \frac{64,35}{11,7} = 5\frac{1}{2}$  yrs. the Anfw.

(16) Here I = 130,47518, P = 500, and r = ,065. Then per Theo.  $\frac{130,47938}{,065 \times 500} = \frac{130,47516}{32,5} = 4,0144 + = 4$ Years, 5,25 Days, the Answer. Theorem VI.  $\frac{a-P}{Pr} = t$ , the Time.

(17) Here a=354,2208 g, P=284,5, and r=,0325. Then per Theo.  $\frac{354,2208}{284,5} = \frac{70,7208}{9,24625} = 7,65405$ =7 Years, 238,7 Days, the Answer.

(18) Here a=847.875, P=672.25, and r=.0475. Then per Theo.  $\frac{847.875-672.25}{672.25\times.0475} = \frac{175.625000}{31.931875} = 5\frac{1}{2}$  ys. the Answer.

(19) Here a=500,464583, P=378,9, and r=.05. Then per Theo.  $\frac{500,464583,-378,9}{378,9\times.05} = \frac{121,564583}{18,945} = 6,41467=6 \text{ Years, 5 Months, (nearly) Answer.}$ Theorem VII.  $\frac{I}{pt} = r$ , the Rate.

(20) Here I=69,675, P=464,5, and t=3. Then per Theo.  $\frac{69,675}{494,5\times3} = \frac{69,675}{1393,5} = 0,05$ , or 5 per Ct. the Rate required.

(21) Here I=64,35, P=260, and t=5.5.

Then per Theo.  $\frac{64,35}{200 \times 5,5} = \frac{64,35}{1430} = 0.045$ , or  $4\frac{1}{2}$  per Ct.

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(22) Here I=235,46, P=560,635416, and t=7. Then per Theo.  $\frac{225,26}{560,635416\times7} = \frac{235,46666666}{3924,447916} = ,06$ , or 6 per Cent. the Answer. Theorem VIII.  $\frac{a-P}{Pt} = r$  the Rate.

(23) Here a=354,2208 g, P=284,5 and t=7. Then per Theo. 354,2208 g -284,5 69,7208 g = ,035, or  $3\frac{1}{2}$  per Cent. the Answer.

(24) Here a=500,4635416. P=378,9, and t=6. Then per Theo.  $\frac{500,4635416-378,9}{378,9\times6} = \frac{121,5635416}{2^273,4}$ , 05372 +, or 5f. 6s. 11 $\frac{1}{4}d$ : ,312, per Cent. the Anfw.

(25) Here a=847,875, P=672,25, and t=5.5. Then per Theo.  $\frac{847,875-672,25}{672,25\times5.5}=\frac{175,62500}{3697,375}=,0475$ . or  $4\frac{3}{4}$  per Cent. the Answer.

60. Of ANNUITIES, PENSIONS, &c. in ARREARS, at SIMPLE INTEREST.

Theorem 9.  $\frac{t \, t \, u - t \, u}{2} \times r : + t \, u = A$ , the Amount.

(26) Here u=250, t=6, and r=.03. Then per Theo.  $\frac{250\times 6\times 6-250\times 6}{2}\times.03:+250\times 6=$ 

9000-1500 2,03: +5100=3750×,03+1500=1125, +1500=1612,5, or 1612£. 10s. the Answer.

(27) Here u=125, t=12, and r=0.015, per Note.

Then per Theo.  $\frac{125 \times 12 \times 12 - 125 \times 12}{2} \times ,015 + 125 \times 12 = \frac{18000 - 1500}{2} \times ,015 + 1500 = \frac{8250}{2} \times ,015 + 1500 = 123,75 + 1500 = 1623,75 = 1623 £. 155. the Anf.$ 

(28) Here u=62,5,t=24, and r=,0075, per Note. Then per Theo.  $\frac{62.5\times24\times24-62,5\times24}{2}\times,0075:+$   $\frac{62.5\times24}{2}\times,0075:+$   $\frac{36000-150}{2}\times,0075:+$  1500=  $\frac{17250\times,0075}{1629 \pounds. 7s. 6d. the Answer.}$ 

Theorem X.  $\frac{2a}{t t r - t r + 2t}$  = U, the Annuity.

(29) Here a=1612,5, t=6, and r=.03. Then per Theo.  $\frac{1612.5\times2}{6\times6\times.03-6\times.03\times2} = \frac{3225.0}{2.9} = 250f$ . the Answer. Theo. for half yearly Payment.  $\frac{4^a}{ttr-tr+2t} = U$ .

(30) Here  $\alpha = 1623,75$ , t = 12, and r = ,015.

Then per Theo.  $\frac{1623,72 \times 4}{12 \times 12 \times .015 - 12 \times ,05 + 12 \times 2}$   $\frac{6495}{1,98 + 24} = \frac{6495,00}{25,98} = 250 \text{£. the Answer.}$ Theo. for quarterly Payment.  $\frac{8 \text{ a}}{t \text{ tr} - t \text{ r} + 2t} = \text{U.}$ 

(31) Here a=1629,375,t=24, and r=,0075. Then per Theo.  $\frac{1629,375\times8}{24\times24\times,0075-24\times,0075+24\times2} = \frac{13035}{4,14\times48} = \frac{13035,00}{52,14} = 250f$ . the Answer. Theo. XI,  $\frac{2a-2ut}{utt-ut}=r$ , the Rate.

(32) Here a=1612,5, u=250, and t=6.

Then per Theo. 
$$\frac{16.12, \times 2 - 250 \times 2 \times 6}{250 \times 6 \times 6 - 250 \times 6} = \frac{3225 - 3000}{9000 - 1500} = \frac{225.00}{7500} = ,03$$
, or 3 per Cent. the Answer.

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Theo. for half yearly Payments,  $\frac{4a-4ut}{utt-ut}=r$ .

(33) Here a=1623.75, u=125, and t=12, per Note.

Then per Theo. 
$$\frac{1623.75 \times 4 - 125 \times 4 \times 12}{125 \times 12 \times 12 - 125 \times 12} = \frac{6495 - 6000}{18000 - 1500}$$
$$= \frac{495.00}{16500} = .03 \text{ or 3 per Cent. the Answer.}$$

Theo. for quarterly Payments. 8 a-8 ut - r

Then per Theo. 
$$\frac{1629,375\times8-62,5\times8\times24}{62,5\times24\times24\times-62,5\times24}$$

$$\frac{13035-12000}{36000-1500} = \frac{1035,00}{34500} = 0,03$$
, or 3 per Cent. Answ.

Theorem XII. First 
$$\frac{2}{r}$$
 = X. Then  $\frac{\sqrt{\frac{2a}{2a} + \frac{x_x}{4}} \cdot \frac{x}{2}}{2}$  = T.

(35) Here a 1=1612,5, u=250, and r=,03,

Then per Theorem I. 
$$\frac{2}{.03}$$
  $1=65,6=X$ .

Then 
$$\frac{\sqrt{1612.5\times2}}{252\times.02} + \frac{65.8\times65.8}{4} = \frac{65.8}{2}$$

$$\frac{\sqrt{3225}}{7.5} + \frac{4.307.73}{4} = 32.8 = \sqrt{1506.93} - 32.8 = 38.8 - 32.8 = 38.8 = 3$$

32,8=6 Years, the Answer.

Then per Theorem I. 
$$\frac{2}{1,015}$$
 1=132,3=X.

Then 
$$\frac{\sqrt{1623.75 \times 2} + \frac{132.3 \times 1328}{4}}{\frac{125 \times ,015}{1,875} + \frac{17507.68}{4}} = \frac{132.8}{4} = \frac{132.8}{2} = \frac{3247.5}{1,875} + \frac{17507.68}{4} = -66, = \sqrt{1752 + 4370.92}$$
  
:-66, 1 =  $\sqrt{6108.92 - 66}$ , 1 = 78, 1 -66, 1 = 12  
Half yrs. or 6 yrs. the Time required.

(37) Here a=1629,375. u=62,5, and r=,0075. Then per. Theorem I.— r=265,6=X.

Then 
$$\frac{\sqrt{\frac{1629,375\times2}{62,5}\times\frac{205,8}{2}}}{\frac{62,5}{4}\frac{205,8}{2}} + \frac{\frac{2858}{2}}{2} = \frac{\sqrt{\frac{3^258,75}{3^258,75}} + \frac{70761,08}{4}}{4} : -132,8 = \sqrt{\frac{6952}{17090,26}}} = \frac{132,8 = \sqrt{24642}}{26 - 132,8 = 1569,-132,8 = 24}$$
Quarterly Payments, or 6 Years, the Answer.

61. PRESENT WORTH of ANNUITIES, &c.

Theorem XIII.  $\frac{ttr-tr+2t}{2tr+2}$ :  $\times u=P$ . The prefent Worth

(38) Here t=6, t=0.03, and t=250.

Then per Theo.  $\frac{6\times6\times,03-0\times03+6\times2}{2\times6\times,03+2}$ :  $\times$  250=1

$$\frac{1,08-,18+12}{,36+2}$$
 ×  $\frac{12,9}{2,36}$  ×  $\frac{$ 

(39) Here t=12. r=,015, and u=125.

Then per Theo.  $\frac{12 \times 12 \times ,015 - 1 + 015 + 12 \times 2}{12 \times 2 \times ,015 + 2} : \times 125$   $= \frac{2.06 - ,1 \times + 24}{.36 + 2} : \times 125 = \frac{1.98 + 24}{2.36} : \times 125 \times 125$ 

$$^{,36+2}$$
 $^{25,98}$ 
 $\times$  12=11,008474 $\times$ 125=1376,05925=1376 $f$ .

15. 2d.,22 the present Worth.

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(40) Here given t=24, u=62,5, and r=,0075.

Then per Theo.  $\frac{24 \times 24 \times ,0075 - 24 \times ,0075 + 24 \times 2}{24 \times 2 \times ,0075 + 2}$ : ×

 $6,25 = \frac{4,32 - 18 + 48}{2,36} : \times 62,5 = \frac{4.14 + 48}{2,36} : \times 62,5$ 

 $= \frac{5^{2,14}}{^{2,36}}: \times 6^{2,5} = 2^{2,09322} \times 6^{2,5} = 1380,8^{2625} = 1380 \cdot . 16s. 6d. \cdot 3, \text{ the Answer.}$ 

Theorem XIV.  $\frac{tr+1}{ttr-tr+2t}:\times 2p=U, \text{the Annuity}$ 

(41) Here is given t=6, r=0,03, and p=1366,525. To find U.

Then per Theo.  $\frac{1}{6 \times 6 \times ,03-6 \times ,03+6 \times 2}$ : × 1366,525×2  $= \frac{1,18}{12,9} \times 2733,05 = .0914728 \times 2733,05 = 250 \text{£. the}$ Annuity required.

(42) Here is given t=12, r=,015, and p=1376, 25. To find U.

Then per Theo.  $\frac{12\times,015+1}{12\times12\times,015-12\times,015+12\times2}:\times$   $1376,25\times4=\frac{1,18}{25,98}\times5505=,0454195\times5505=250f.$   $8\frac{1}{2}d. \text{ the Annuity required.}$ 

(43) Here is given t=24, r=,0075, and p=1380,875. To find U.

Theorem XV.  $\frac{ut-p\times 2}{2pt+ut-utt} = R$ , the Rate.

(44) Here is given, u=250, t=6 and, p=1366,525. To find R.

Then per Theo.  $\frac{250 \times 6 - 1366,525 \times 2}{1386,525 \times 2 \times 6 + 250 \times 6 - 250 \times 6 \times 6}$  $= \frac{133,475 \times 2}{17898,39-00} = \frac{266,95}{8893,3} = ,03 = 3 \text{ per Cent the Anf.}$ 

(45) Here is given u=125, t=12, and p=1376,25. To find R.

Then per Theo.  $\frac{125 \times 12 - 1276.25 \times 2}{1376.25 \times 2 \times 12 + 125 \times 12 - 125 \times 12 \times 12}$   $= \frac{1500 - 1376.25 \times 2}{33030 + 1500 - 18000} \frac{123,75 \times 2}{34520 - 18000} \frac{2475}{165000}$ =,015 half the Rate, which  $\times 2 =$ ,03 or 3 per Cent. the Answer.

(46) Here is given u=62,5, t=24, and p=1380,875. Then per Theorem.

 $\frac{62,5\times24-1380,875\times2}{1380,875\times2\times24+52,5\times24-62,5\times24\times24}$ 

 $\frac{238,25}{-}$  = .0075, which  $\times$  4 = .03 or 3 per Cent. the 31782 Answer.

Theo. XVI.  $\frac{2}{r} = \frac{2p}{u} = 1 = X$ . Then  $\sqrt{\frac{2p}{u}} + \frac{xx}{u} = x$  the Time.

(47) Here is given u=, 250. p=1366,525, and r=,03.

Then per Theo. first  $\frac{2}{.03} \frac{1366.525 \times 2}{.03} - 1 = 66.6$ 

Then  $\sqrt{\frac{1365.525 \times 2}{25 \times ... \times}} + \frac{54.723446 \times 54.73446}{4}$ 

 $\frac{54.73446}{27.5} = \frac{\sqrt{27.43.05}}{7.5} + \frac{2005080}{4}$ 27.3= $\sqrt{1113.36}$  = 27.5=33.3-27.3=6 Years, the Answer.

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(48) Here is given = 125, p=1376,25, and r=,015. 1376,25×2 Then per Theo. first-,015 125

23,02=110,31 g=X.

Then  $\sqrt{\frac{1376,25\times2}{125\times,015}} + \frac{110,313\times110,313}{4} - \frac{110.313}{2} =$ V4510,2486-55,15=67,15-55,15=12 half yearly Payment, or 6 Years the Time required.

(49) Here is given, u=62.5, p=1380.8-5, and r=,0075.

Then per Theo. first  $\frac{2}{0.075}$   $\frac{1380.875 \times 2}{62.5}$  1 = 266.645,188 = 221,4786=X. Then  $\sqrt{\frac{1380,875 \times 2}{62,5 \times ,0075}}$  +  $\frac{221,4786 \times 221,4786}{4}$  $221,4786 = \sqrt{5891,733} + 12203,1901 - 110,7393 =$ V18154,92-110,7=134,7-110,7=24 quarterly Payments, or 6 Years, the Time required.

ANNUITIES, &c. taken in REVERSION.

Theo. XVII.  $\frac{ttr-tr+2t}{2tr+2}$ :  $\times u=p$ , which change to a Then  $\frac{a}{t + 1} = p$ , the present Worth.

(50) Here first U=250, t=6, and R=,03, then perTheo.I.  $\frac{ttr-tr+2t}{2tr+2}:\times U = \frac{6\times6,03}{6\times,03\times2+2}:\times 250 =$  $\frac{1.08-.18+12}{.36+2}$   $\times 250 = \frac{.9+12}{2.30} \times 250 = \frac{12.9}{2.36} : \times 250 =$  $5,4661016 \times 250 = 1366,5254 = P$ . Now per Rule 2. A = 1366,5254, t = 4, and r = .03.

Then per Theo. II.  $\frac{a}{tr+1} = \frac{1366,5254}{4\times,03+1} = \frac{1366,5254}{1,12} = \frac{1366,5254}{1$ 

(51) Here is given first r=.045, t=7.5, and u=80. Then per Theo. I.  $7.5 \times 7.5 \times .045 - 7.5 \times .045 + 7.5 \times 2$ 

$$7.5 \times 2 \times .045 + 2$$

$$: \times 80 = \frac{2.53125 - .3375 + 15}{2.675} \times 80 = \frac{17.10375}{2.675} \times 80 =$$

 $6,42756 \times 80 = 514,2048 \times p$ . Now per Theo. II. p=a, and r, as before =5.

Then  $\frac{514,2048}{5\times045+1} = \frac{514,2046}{1,225} = 419,95759 = 419f$ . 19s.  $1\frac{3}{4}d$ . the Answer.

(52) Here is given u=40, t=10, and r=.05.

Then per Theo. I.  $\frac{10\times10\times.05-10\times.05+10\times2}{10\times2\times.03+2}\times40$ 

 $= \frac{4.5 + 20}{1 + 2} \times 40 = \frac{24.5}{3} \times 40 = 80.16 \times 40 = 326.6 = p.$ 

Now per Theo. II. a=326,  $\beta$ , and t=7.

Then  $\frac{326.6}{7 \times .05 + 1} = \frac{326.8}{1.35} = 241.9755 = 241 \text{£.}$  19s. 6d. ,12, the prefent Worth.

Theorem XVIII. ptr+p=A, the Amount. Change A, and call it p, and t here will = the Time of its Continuance.

Then  $\frac{tr+1}{ttr-tr+2t}$ :  $\times 2p=U$ , the Annuity, &c.

(53) Here is given p=1220,11458g, t=4, and r=.03. Then per Theorem I.  $1222,111458g \times 4\times.03$ . 1220,111458g = 146,413375 + 1220,111458g = 1366,52483 = A. Now, A. chanegd, it becomes p, and t=6.

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Then per Theo. II. \frac{6 \times .03 + 1}{6 \times 6 \times .03 - 6 \times .03 + 6 \times 2}
     1366,52483 \times 2 = \frac{1,18}{12,9} \times 2733,049666 = 2723,049666
     X,0914728=250 f. the Annuity.
(54) Here is given p=419,755208, t=5, and r=,045.
Then per Theorem I. 419,755208 × 5 × ,045+419,755208
     =94,4449218+419,755208=514,2001298=A.
  Now A changed becomes p, and t here=7.5.
                               7,5 × ,04 + 1
  Then per Theo. II .___
                     7,5\times7,5\times,045-7,5\times,045+7'5\times2
     \times 514,2001298 \times 2 = \frac{1,337.5}{17,19375} \times 1028,4002596 =
     ,077789×1028,4002596=80f. the Answer.
(55) Here is given p=241,975308, t=7, and r=.05.
   Then per Theorem 1.241,975308 X 7,05 + 241,975308
     =326,6666658=A.
   Now, A. changed becomes p=326,6666658, and t=10.
   Then per Theo. II. 10 × .05+1
10 × 10 × .05-10 × .05+10×2
        326,6666658 \times 2 = \frac{1.5}{24.5} \times 653,33333316 =
   653,3533316×,06122448=80£. nearly the Answer.
          REBATE OR DISCOUNT.
   Theorem XIX. \frac{3}{t + 1}=P, the present Worth.
 (56) Here s=150, t=75, and R=,05; then per Theorem
                                 150
                                      = 144,5784+or
            ,75×,05+
                                1,0375
     1441. 11s. 63d. the present Worth required.
 (57) Here is given s=1000.t=5mo.=, 116 yr. andr=,045.
                                       1000
                                              =981,595=
   Then per Theo.____
                                      1,01875
                     ,4 &x,045+1
     981f. 11s. 103d. the present Worth. required.
```

- - And 9342-9038,9=303,1=303£. 25. the Discount. Theorem XX. P tr+p=S. the Sum due.

6

- (59) Here is given p=144,578125, t=.75, and r=.05Then per Theo.  $144,578125 \times .75 \times .05 + 144,578125 = 5.421679 + 144.578,125 = 149,9998$ , or rather 150£. the Answer.
- (60) Here is given p=981,52085, t=,416, and r=,045. Then per Theorem,  $981,52083 \times .416 \times .045 + 981,52 = 18,403518 + 9981,52083 = 999,9243485 = 999£. 185. <math>5\frac{1}{2}d$ . the Sum due.
- (61) Here is given p=9111,185146,t=,8g, and r=,045. Then per Theo.  $9111,185416\times83\times,04+9111,185416$ =303,70618+9111,185146=9414,891326=9414£. 17s. 9\frac{2}{3}d. 6, the Debt.

Theorem XXI.  $\frac{s-p}{pr}$  = T, the Time.

- (62) Here is given s=150, p=144.578125, and r=.05. Then per Theo.  $\frac{150-144.578125}{144.578125 \times .05} = \frac{5.42187500}{7.22890625} = .75$  yr. or 9 Months, the Time required.
- (63) Here is given s=1000, p=981,52083, and r=,045. Then per Theo.  $\frac{1000-981,52083}{981,52083\times,045} = \frac{18.47916}{44,16845749} = .416$ , or 5 Months, the Answer.
- (64) Here is given t=9342, p=9111, 185416, and r=.04Then per Theo.  $\frac{9342-9111,185416}{9111,185416\times.04} = \frac{235,814584}{364,447416} =$ ,63332=7 mo. 18 Days the Answer.

Theorem XXII.  $\frac{s-p}{pt}$  = R, the Rate.

(65) Here is given s=150, p=144,578125, and t=,75

Then per Theo.  $\frac{150-144,578125}{144,578125\times,75} = \frac{5,421875}{108,433595} =$ 

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(1) T

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G

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(3) N

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N

T

(2)

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- (66) Here is given s=1000, p=981,5208 g, and t=,416. Then per Theo.  $\frac{1000-981,52085}{981,52083\times,416} = \frac{18,47916}{40,89570138} =$ ,045 or  $4\frac{1}{2}$  per Cent the Answer.
- (67) Here is given s=9342, p=9111,185416, and t=83. Then per Theo.  $\frac{9342-9111,185416}{9111,185416} = \frac{230.814584}{769,26989582} = ,03 \text{ or 3 per Cent. the Answer.}$

# 64. EQUATION of PAYMENTS.

Theorem XXIII.  $\frac{s}{tr+1}$  = P, the present Worth.

(68) Here is given r=,035, the first t=,5, the second, and the third=,83.
 Then per Theo. the present worth will be as follows, viz.

Paid down 400

1. 
$$\frac{500}{.5 \times .035 + 1} = \frac{500}{1.075} = 491.40049$$

2. 
$$\frac{250}{,6\times,035+} = \frac{250}{1,0213} = 244,78605$$

3. 
$$\frac{250}{83 \times ,035 + 1} = \frac{250}{1,025} = \frac{243,002439}{1380,089179 = p}.$$
1400 = s.

Now per Theo. II.  $\frac{d}{p r} = \frac{19,910821}{1380,8179 \times .035} = \frac{10,0108210}{48,303121205}$ =,41013 or 5 Months nearly the true equatic Time required.

- (69) As 12,3£.: 47 Days :: 949,5£.: 18,45 Days, the Answer.
- (70) Here is given a=542,4,p=384, and t=8,25.

Then per Theo. VIII.  $\frac{a-p}{pt} = \frac{54^2 \cdot 4 - 384}{384 \times 8, 25} = \frac{185.4}{3168} =$ 

### 65. COMPOUND INTEREST.

Theorem I. prt=A, the Amount.

(1) Here is given p=246,5, t=7, and r=1,05. Then per Theorem.

 $246.5 \times 1.05 \times$ 

By Table I thus,

Again 7 yrs. under 3 per Cent. is 1,4071004 Which multiplied by the Principal 246,5

Gives the Amountas before, viz. 346,8502486=346£. 17s. (2) Here is given p=500, t=30, and r=1,045, which

raised to the 30th Power, will give 3,7453181=rt. (See Table I.)

Then 3,7453 181 × 500=1772,65905=1772£. 13s. 2d.

,172, the Amount for 30 Years.

Again, suppose the Amount was required only for 30d. Then r=1,0001206, which raised to the 30th Power,= 1,0036243. (See Table II.) the amount of 1£. for 30 Days.

.: 1,0036243×500=501,81215=501£. 16s. 3d.,156,

the Amount.

Then per Table II. the Amount of if. for 100ds. = 1,0134569; for 90=1,0121031; & for 4=1,0005348.:  $1,2762816 \times 1,013534569 \times 1,012031 \times 1,0005$  48=

1,31097607, the Amount of if. for 5 yrs. 194d. Now 1,31097072  $\times$  423 = 685,640485656  $\times$  685f. 1,310976072, the Amount of if. for 5 yrs. 194d.

Therefore 1,310976072 $\times$ 523=685,640485656=685£.

12s. 9\frac{1}{2}d.,8, the Answer.

Aaz

# Theorem II. $\frac{a}{rt} = P$ .

- (4) Here is given a=243,10126,t=4, and r=1,05. Then per Theo.  $\frac{243,10126}{1,05\times1,05\times1,05\times1,05} = \frac{243,10126}{1,2155063}$ =200£. the Answer.
- (5) Here is given a=346,85 t=7, and r=1,05. Then per Theorem,  $\frac{346,85}{\cdot 0,5 \times 1,05 \times 1,05 \times 1,05 \times 1,05 \times 1,05} = \frac{346,85}{1,4071004}$ = 246,5=246f. 10s. the Answer.
- (6) Here is given a=1872,65905, t=30, and r= 1,045, which raifed to 30th Power=3,7453181. (See Table I.)

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Then per Theo. \(\frac{1872,65905}{3,7453181} = 500\)\(\ell\). the Answer.

(7) Here is given a=685,64, t=5yrs. 194d. and r=1,05 which raised to the Power of t=1,310976.

Then per Theo.  $\frac{685,64}{1,310976}=523$ £. the Answer.

Theorem III.  $\frac{a}{p} = Rt$ .

- (8) Here is given a=346,85,p=246,5 and r=10,5.
   Then per Theo. 346,85/246,5 = 1,4701004=Rt.
   Which ÷ 1,05 till nothing remains, and the Number of Divitions will be 7, or 7 yrs the Answer.
- (9) Here is given a=1872,65905, p=500, and r=1,045.
   Then per Theo. 1872,65905 = 3,7453181=Rt.
   Wihch Number look for in Table I. under 4½ per Cent. and you will find it to be even with 30 yrs. the Anfw.

(10) Here is given a=685,64, p=523, and r=1,05.

Then per Theo. 685,64 = 1,310976= Rt. the nearest Number (less) to which under 5 per Cent, is even with 5 yrs. viz. 1,2762816. Then 1,310976 - 1,2762816=1,027184025 the nearest

Number to which, in Table II. is even with 100 Days,

viz. 1,0134569.

Therefore 1,027184025-1,0134569=1,01264437 the nearest Number (less) to which in Table II. is even with 90 ds. viz. 1,0121031.

So 1,0126437 ÷ 1,012103=1,0005348, which is even

with 4 Days, in Table II.

Therefore the Answer is 5 yrs 194 d.

Theorem IV. 
$$\frac{a}{p}$$
=Rt.

(11) Here is given a=346,85, p=246,5, and t=7.

Then per Theo.  $\frac{346,85}{346,5}$  = 1,4071004 = r, raised to the 7th Power.

Then per Rule in Page 238 r7=V1,4071004=1,05 or 5 per Cent. the Answer.

(12) Here is given a=1872,65905, p=500, and t=30. Then per Theo.  $\frac{1872,65905}{500} = 3.7453181 = rt$ . which Number look for in Table I. and even with 30 yrs. you

will find it to be under 4 per Cent. the Answer.

(13) Here is given a=685,64 p=523, and t=5 yrs. 194d 685,64 = 1,310976=rt. Nowthenearest Then per Theo. Number to which, even with 5 yrs. is under 5 per Cent. the Answer.

### 66. ANNUITIES, PENSIONS in ARREARS.

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Theorem  $V = \frac{Ur^t - u}{\tau - 1} = A$ , the Amount.

(14) Here is given, u=70, t=4, and r=1,04.

Then per Theo.  $\frac{U_{r-1}}{r-1} = 70 \times \frac{1.04 \times 1.04 \times 1.$ 

 $=\frac{70\times1,6985\%6-70}{,04}=\frac{11,8012}{,04}=297,25255 \text{ or } 297f.$ 

gs. o½d. the Amount. By Table III. thus,

Against 4 yrs. and under 4 per Cent. is
Which multiplied by the Annuity

4,246464
70

Gives the present Worth as before, viz. 297,25248

(15) Here is given u=100, t=6, and r=1,05. Then per Theorem

 $\frac{1,05 \times 1,05 \times 1,05}{1,05-100} = \frac{1,05-1}{100 \times 1,3400956-100_{134,00956-100_{234,00956}}}$   $\frac{,05}{=680,192} = 680 £. 3s. 9\frac{3}{4}d. \text{ the Amount.}$ 

(16) Here is given u=70, t=7, and r=1,03; which raised to the 7th Power=1,2298733. (See Table I.)

Then per Theo.  $\frac{70 \times 1,2298733 - 70}{1,03 - 1} = \frac{86,091131 - 70}{0.03} = \frac{16,091131}{0.03} = 536,37103 = 536 £. 7s. 5d. the Answer,$ 

(17) Here is given u=30, t=30, and r=1,035; which raised to the 30th Power=2,8067937 per Table I.

Then per Theo.  $30 \times 2.8067937 - 30 - 84.20381 - 30 =$  1.035 - 1 54.20281

 $\frac{54,20381}{,035}$  = 1548,680257 = 1548£. 13s.  $7\frac{1}{4}d$ . the Amount required.

Theorem VI.  $\frac{ar-a}{rt-1}$  = U, the Annuity, &c.

(18) Here is given a=680, 1912, t=6, and r=1,05; which raised the 6th Power=1,3400956.

Then per Theo.  $\frac{680,1912\times1,05-680,1912}{1,3400956-1}$   $\frac{34,00956}{3400956}$ 

(19) Here is given a=536,37103 (per Quest. 3.) t=7, and r=1,03; which raised to the seventh Power=1,2298733.

Then per Theo.  $\frac{536.3710g \times 1.03 - 536.27103}{1,2298733-1}$   $\frac{552.46219 - 536.37103 - 16.0911632}{,2298733} = 70£. \text{ the}$ Answer.

(20) Here a=1548,680257, t=30, and r=1,035; which raised to the 30th Power=2,8067937 per Table I.

Then per Theo.  $\frac{1548,680257 \times 1,0371548,680258}{2,8067937-1} = \frac{1602,884066-1548,680257}{1,8067937} = \frac{54,203819}{1,8067937} = 30f. \text{ the Answer.}$ 

Theorem VII.  $\frac{ar+u-a}{u} = Rt$ .

(21) Here a=680,1912, u=100, and r=1,05. Then per Theo.  $\frac{680,1011 \times 1,05 + 100 - 680,1912}{100}$ 

 $\frac{814,20076-680,1912}{100} = \frac{340,0956}{100} = 3,400956 = Rt.$ 

which proceed with as directed in Example 8, will give 7 yrs. the Answer.

(22) Here a=536,37103, u=70, and r=1,03. Then per Theo.  $\frac{136,37103 \times 1,03+70-536,37103}{70} = \frac{622,46219-536,37103}{70} = \frac{86,09113}{70} = 1,2298733 = \frac{1,2298733}{100} = \frac{1,229873}{100} = \frac{1,22987$ 

Rt. which proceed with as before directed, will give 7 yrs. the Answer.

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(23) Here a=1548,680257, u=30, and r=1,035.

Then per Theo.  $\frac{1548,68025}{30} \times .053 + 30 - 1548,680257$ =  $\frac{1632,884066 - 1548,680257}{30} = \frac{84,203809}{30} = \frac{1632,884066}{30} = \frac{1632,88406}{30} = \frac{1632,88406}{30}$ 

2,8067936=Rt. which Number look for under 3½ per Cent. and you will find it to be even with 30 yrs. the Answer. (See Table I.)

Theorem VIII.  $\frac{ar}{u} - rt = \frac{a-u}{u} = Rt$ .

- (24) Here a=680,1912, u=100, and t=6. Then per Table 680,1912, ÷100=6,801912=rt, even with 6 yrs. you will find it to be under 5 per Cent.
- (25) Here a=536,37103, u=70, and t=7.
  Then 536,37103:70=7,662729=Rt. then in Table III.
  even with 7 yrs. you will find it to be under 3 per
  Cent. the Answer.
- (26) Here a=1548,680257, u=30, and t=30.
  Then 1548,680257:30=51,6226752=Rt. which even with 30 yrs. you will find it to be under 3½ per Cent. the Answer.

# 67. PRESENT WORTH of ANNUITIES.

Theo, IX.  $u = \frac{u}{rt}$ ;  $\div r = 1 = P$ , the present Worth.

(27) Here U=50, t=8, and r=1,05, which being involved to Rt=1,4774554 by the 1st Table.

Then per Theo. U  $-\frac{u}{rt} \div r - 1 = 50 - \frac{50}{1,477454}$  $\frac{\div}{1,05-1} = 50 - 33,84196 \div,05 = 16,15804 \div$ .05 = 323,1608, or 323£.  $35.2\frac{1}{2}d$ .

By Table V. thus,

Against 8 yrs. and under 5 per Cent. is 6,4632128
Which multiplied by the Annuity, viz. 50

Gives the prefent Worth, viz.

323,16064

(28) Here is given u=60, t=6, and r=1,04. Which being involved to the 6th Power = 1,265319, per Table 1.

Then per Theo. 60  $\frac{60}{1,265319}$ :  $\div 1,04 - 1 = \frac{60-47,41096}{,04} = \frac{12,58904}{,04} = 314,726 = 314£.141.61d.$ the Answer.

(29) Here u=1000, t=21, and r=1,045. Which being involved to the 21st Power =2,5202411, per Table L.

 $\frac{1000 - 396,787434}{,045} = \frac{603,2125657}{,045} = 1340472386 =$ 

13404£. 14s. 53d. the Answer.

Theorem X.  $\frac{prt \times r - prt}{rt - 1} = U$ , the Annuity.

(30) Here is given p=323,1608, t=8, and r=1,05; which being involved to the 8th Power = 1,4774554, per Table I.

Then per Theorem,

 $3^23,1608 \times 1,4774554 \times 1,05 - 3^23,1608 \times 1,4774554$ 

 $= \frac{501,3380 - 477,46567}{4774554} = 50 £. \text{ the Annuity.}$ 

(31) Here p=314,726, t=6, and r=1,04; which being involved to the 6th Power=1,265319.

Then per Theorem.

$$\frac{314.726\times1.265319\times1.04-314.726\times1.265319}{1,265319-1}$$

$$\frac{414.157939-398.228785}{,265319} = \frac{15.92815}{,265319} = 60 £. the An.$$

(32) Here p=13404,72386, t=21, and r=1,045; which being involved to the 21st Power = 2,5202411, per Table I.

Then per Theorem,

nuity required.

$$13404.72386 \times 2.5202411 \times 1.045 - 13404.7236$$
 $2.5202411 - 1$ 

 $\frac{\times 2,5202411}{1,5202411} = \frac{353,0337712 - 337.83136 - 1520,2411}{1,5202411}$ 

=1000f. the Annuity.

Theo. XI. 
$$\frac{u}{p+u-pr}$$
 = Rt.

(33) Here is given u=50, p=323,1608, and r=1,05.

Then per Theorem, 
$$\frac{50}{3^23,1608+50} - \frac{50}{323,1608 \times 1,05}$$

$$= \frac{50}{33,84196} = 1,4774554 = \text{Rt. which proceed with as}$$
in Example 8, and the Number of those Divisions will be 8, that is, 8 yrs. the Answer.

(34) Here u=60, p=314,726, and r=1,04.

Then per Theorem, 
$$\frac{60}{314.726 + 60 - 314.726 \times 1.04}$$

$$\frac{60}{374.726 - 327.315} = \frac{60}{47.411} = 1.265319 = Rt.$$
which proceed with as in the last Example, and the Number of Divisions will be 6, which is 6 yrs. the Answer.

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(35) Here u=1000, p=13404,72386, and r=1,045. Then per Theorem,

 $\frac{1000}{13404,72386+1000-13404,72386, \times 1,045.}$   $\frac{1000}{14404,72386-14007,936433}$   $\frac{1000}{395,787426}$ 

2,5202411=Rt. which in Table I. under 4½ per Cent. is even with 21 Years, the Answer.

Theorem XII.  $\frac{u}{p} = \frac{u}{p} Rt. + Rt. - Rt. + 1$ .

To perform the three following Examples by the Theorem, see the Appendix.

- (36) Here is given u=50, p=323,1608, and t=8. Then by the fifth Table thus,

  First 323,1608 ÷ 50=6,4632 f6. Then even with 8 yrs. you will find it under 5 per Cent, the Answer.
- 37) Here u=60, p=314,726, and t=6.

  Then 314,726÷60=5,24548, which Number look for in Table V. even with the given Time, and the nearest Number is under 4 per Cent. the Answer.
- 38) Here u=10000, p=13404,72386.

  Then 13404,72386 ÷ 1000=13,40472386, which Number even with the given Time, you will find under 42 per Cent. the Answer.
- 68 ANNUITIES, LEASES, &c. taken in REVERSION.

Theorem I.  $u - \frac{u}{r} : \div r - 1 = p$ , which change to A.

Then A  $\frac{A}{Rt} = p$ .

39) 1. Here u=80, t=6, and r=1,05, then per Rule 1.  $u-\frac{u}{rt}$   $\div r-1=80-\frac{80}{1,3400955}$   $\div 1,05-1=80-$ 

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59,6976:,05=20,3028:,05=406,056=P. Then per Rule 2. A=406,056, t=2, and r, as before, and per Theorem 2,  $\frac{a}{rt} = \frac{406,056}{41,1025} = 368,30419$ , or  $368 \pounds$ . 6s. 1d. the prefent Worth required.

Thus, by Table V. 2+6=8 Years.

Then  $\begin{cases} 6,4632128 = \text{Value of 11. for 8 Years.} \\ 1,8594104 = \text{ditto for 2 Years.} \end{cases}$ 

Remains 4,6030024
Which X 80 Annuity.

Gives £.368,304192 as before.

(40) Here is given u=1000, t=20, and r=1,05. Which involved to the 20th Power =2,6532977 per Table I.

Then per Theo. I.  $1000 \frac{1000}{2,6532977} : \frac{1}{1,05-1} = \frac{1000-376,88948}{1000-376,88948} \div ,05 = 623,11052 \div ,05 =$ 

1246,22104=p.

Now per Rule II. a=124622104, t=5, and r as before; which being involved to the 5th Power=1,276816.

Then per Theo. II. 1246,22104 = 9767,60175 = 97674.

Theorem, first pri=A, which change to P.

Then  $\frac{prt \times r - prt}{rt - 1} = U$ , the Annuity.

(41) Here p=368,30419, t=2, and r=1,05; which being involved to the 2d Power=1,1025 per Table I.

Then per Theo. I. 368,30419×1,1025=406,05536=A

Now per Rule II. p=406,05536, t=6, and r as before which being involved to the 6th Power=1,3400956.

Then per Theorem II.

406,05536×1,3400956×1,05—406,05536×1,340095

1,3400956—1 =571,360652—544,153002=272,0765=80£. the 3400956
Annuity required. (42) Here for 8132,14,8 read 976,7£. 125. 04 78=p= 9767,60175, t=5, and r=1,05; which being involved to the 5th Power, =1,2762816.

Then per Theorem I. 9767;60175 × 1,2762816 =

12466,2 103896≟A.

Now per Rule II. p=12466,2103896, t=20, and r as before; which being involved to the 20th Power = . 2,6532977 per Table I.

Then per Theorem II.

12466,2103896×,6532977+1,05-12466,2103896 2,6532977-1  $\times 2,6532977 = 34739,30572229 - 33076,56735457$ 1,0532977  $= \frac{1,65382836}{1,6532977} = 1000 \text{£. the Annuity.}$ 

### 69. REBATE or DISCOUNT.

Theorem XIII.  $\frac{s}{rt} = p$ , the present Worth.

(43) - Here  $\frac{s}{rt} = \frac{150}{1,2155063} = 123,40536$ , or 1231.8s. 14d present Worth required.

By the Table, thus, ,8227025×150=123,405375, as

before.

Here s=743,237;, t=6, and r=1,04; which being involved into the 6th Power=1,265319.

Then per Theo. 743,2375 -1,265319=587,891=587£. 7s. 92d. the Aniwer.

Theorem XIV. prt=S, the Sum owed.

Here p=123,405208, t=4, and r=1,05; which being involved to the 4th Power=1,2155063=pt. Then per Theorem, 123,405208 X 1,2155063=150f. the

Debt.

(46) Here p=587,391, t=6, and r=1,04; which being involved to the 6th Power=1,26;319, per Table I. Then per Theorem, 587,391 X 1,265319=743,237=

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59,6976;,05=20,3028;,05=406,056=P. Then per Rule 2. A=406,056, t=2, and r, as before, and per Theorem 2,  $\frac{a}{rt} = \frac{406,056}{41,1025} = 368,30419$ , or 368 f. 6s.

1d. the present Worth required.

Thus, by Table V. 2+6=8 Years.

Then \ 6,4632128=Value of 11. for 8 Years. \ 1,8594104=ditto for 2 Years.

Remains 4,6030024
Which X 80 Annuity.

Gives £.368,304192 as before.

(40) Here is given u=1000, t=20, and r=1,05. Which involved to the 20th Power =2,6532977 per Table I.

Then per Theo. I.  $1000 \frac{1000}{2,6532977} : \frac{1}{1,05} = 1$ 

 $1000 - 376,88948 \div ,05 = 623,11052 \div ,05 = 1246,22104 = p$ 

Now per Rule II. a=124622104, t=5, and r as before; which being involved to the 5th Power=1,276816.

Then per Theo. II.  $\frac{1246,22104}{1,2762816} = 9767,60175 = 9767 f$ .

Theorem, first pri=A, which change to P.

Then  $\frac{prt \times r - prt}{rt - 1}$  = U, the Annuity.

(41) Here p=368,30419, t=2, and r=1,05; which beins involved to the 2d Power=1,1025 per Table I.

Then per Theo. I. 368,30419×1,1025=406,05536=A.

Now per Rule II. p=406,05536, t=6, and r as before; which being involved to the 6th Power=1,3400956.

Then per Theorem II.  $406,05536 \times 1,3400956 \times 1,05-406,05536 \times 1,3400956$ 

 $= \frac{571,360652 - 544,153002}{,3400956} - \frac{272,0765}{,3400956} = 80 £. the Annuity required.$ 

(42) Here for 8132,14,8 read 976,7£. 125.  $0\frac{1}{4}$  78=p= 9767,60175, t=5, and r=1,05; which being involved to the 5th Power, =1,2762816.

Then per Theorem I. 9767,60175 X 1,2762816 =

12466,2103896≐A.

Now per Rule II. p=12466,2103896, t=20, and r as before; which being involved to the 20th Power = 2,6532977 per Table I.

Then per Theorem II.

 $\frac{2,6532977 + 1,05 - 12466,2103896}{2,6532977 - 1}$   $\frac{2,6532977 - 1}{2,6532977 - 34730,30572229 - 33076,56735457}$   $=\frac{1,65382836}{1,6532977} = 1000 \text{£. the Annuity.}$ 

2977

# 69. REBATE or DISCOUNT.

Theorem XIII.  $\frac{s}{rt} = p$ , the present Worth.

(43) - Here  $\frac{s}{rt} = \frac{150}{1,2155063} = 123,40536$ , or 1231.8s. 14d prefent Worth required.

By the Table, thus, ,8227025×150=123,405375, as

before.

e;

56

the

(44) Here s=743,237;, t=6, and r=1,04; which being involved into the 6th Power=1,265319.

Then per Theo. 743, 2375  $\div$ 1,265319=587,891=587£. 7s. 9\frac{2}{3}d. the Aniwer.

Theorem XIV. prt=S, the Sum owed.

(45) Here p=123,405208, t=4, and r=1,05; which being involved to the 4th Power=1,2155063=pt.

Then per Theorem, 123,405208 × 1,2155063=150 £. the Debt.

(46) Here p=587,391, t=6, and r=1,04; which being involved to the 6th Power=1,265319, per Table I.

Then per Theorem, 587,391 × 1,265319=743,237=743 £. 4s. 9d. the Answer.

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(54

(5t

(5)

Theorem XV.  $\frac{s}{p} = rt$ .

(47) Here p=123,405208, s=150, and r=1,05. Then per Theorem, 150-123,405208=1,2155063=rt; which being continually divided by 1,05 till nothing remains, the Number of those Divisions will be 4, that is 4 Years the Answer.

Here p=587,391, s=743.235, and r=1,04Then per Theorem, 743,235 - 587,339100=1,2653191 which proceed with as directed in the last Example, and the Number of Divisions will give 6 Years, the Answ.

Theorem  $X\dot{V}I.\frac{s}{p} = Rt.$ 

Here s=150, p=123,405208, and t=4. (49)

Then per Theo.  $\frac{150}{123,405208} = 1,2155063 = r^4$ .

:.  $\sqrt{1,2155063} = 1,1025$ , and  $\sqrt{1,1025} = 1,05$  or 5 per Cent. the Answer.

Here s=743,235, t=587,3391005, and t=6. Then per Theo. 744,235 - 587,3391005=1,265319=16.

Then V1,265319=1,124864.

And V1,124864=1,04 or 4 per Cent. the Answer. (See the Guide, Page 208.)

### 70. PURCHASING FREEHOLD or REAL ESTATES.

Here u=500, and r=1,05.

Then per Theorem  $\frac{1,05-1}{500} = \frac{500}{,05} = 10000 f$ .

Theorem XVII.  $\frac{u}{r-1}$  = P, the present Worth.

(52) Here u=25, and r=1,045.

Then per Theo.  $\frac{25}{1,045-1} = \frac{25}{0.045} = 555.5 = 555 £. 115.$ 14d. ,28, the Answer.

Then per Theo. XVIII.  $\frac{P+u}{p}$ =R, the Rate per Cent.

## Purchasing Freehold Estates in Reversion. 279

(53) Here p=10000, and u=500.

Then per Theo.  $\frac{10000 + 500}{10000} = \frac{10500}{10000} = 1,05$ , or 5 per Cent. the Answer.

(54) Here p=555,5, and u=25.

Then per Theo.  $\frac{555.5+25}{555.5} = \frac{580.5}{555.5} = 1,045 \text{ or } 4^{\frac{1}{2}} \text{ per}$ Cent. the Answer.

Theo. XIX. PXr-1=U, the Annuity.

(55) Here p= 10000, and r=1,05.

Then per Theo. 10000 × 1,05—1=10000 × ,05=500 £.
the Answer.

(56) Here p=555,5, and r=1,045.

Then per Theo. 555,5×1,04,—1=555,5×,045=25£. the Answer.

# 71. PURCHASING FREEHOLD ESTATES in REVERSION.

Theorem XX. First  $\frac{u}{r-1}$  = P, which change to A.

Then  $\frac{a}{Rt}$  = P, the present Worth.

(57) Here u=500, and r=1,05.

Then per Theo. I.  $\frac{500}{1,05-1} = \frac{500}{,05} = 10000 = P$ . which change to a.

Then per Theo. II. a=10000, t=4, and r as before; which involved to the 4th Power=1,2155063.

Then per Theo. II.  $\frac{10000}{1,2155063} = 8227,024 = 8227 f. 5\frac{3}{4}d.$ 

Theorem XXI. First prt .= A, which change to P.

```
Then \frac{prtr-pr}{r}=U, the Annuity.
```

(58) Here p=8227,024, t=4, and r=1,05; which being involved to the 4th Power =1,2155063.

Then per Theo. I. 8227,024 × 1,2155063 = 10000,=A. Now per Rule II.) p=10000, and r as before.

Then per Theo. II. 10000 × 1,05 × 1,05 — 1000 × 1,05

= 11025-10500 525.00 500£. the Answer.

### QUESTIONS for EXERCISE.

(59) First 486,5£.—94=392,5£. the Annuity.
Now the present Worth of 1£. for 7, 14, and 21 yrs. at
5 per Cent. is 5,7863737,9,8986409, and 12:8211427,
(per Table V.)

Then  $\begin{array}{c}
5,7863737 \\
9,8986409 \\
12,8211527
\end{array}$   $\times 362,5 = \begin{cases}
2271,1507 = 2271 & 3 & 0 \\
3885,21655 = 3885 & 4 & 4 \\
5032,30243 = 5032 & 6 & 0
\end{cases}$   $\begin{array}{c}
14 \\
5032,30243 = 5032 & 6
\end{array}$ 

(60) First 15+5=20 yrs. and 186£. 7s. 6d.=186,375£.

Then the Worth of 1£. for 20 yrs. = 13.5903253

And ditto for 15 yrs. = 11,1184858

Diff. 2,4719395

(62

6,0

6,0

(63

(64

(65

(66

.. 2,4719395×186,375=460,70753=460£. 14s. 11d. the Fine required.

(61) First 7+14+10=31 Years.

Now the present Worth of 1f. at 5 per Cent. for 31,21, and 7 yrs. is 5,7863734, 12,8211527, and 15,5928104. Then

 $\begin{array}{c|c}
15,5928104 \\
12,8211527 \\
5,7863734
\end{array} \times 50 = \begin{cases}
779,64082 \\
641,057635 \\
289,31867
\end{cases}$ Prefent Worth  $\begin{cases} 31 \\ 21 \\ 7\end{cases}$ 

(62) By Table V. the present Worth or 300 f. per Annum for 7 Years at 4 per Cent. is 6,002547 × 300 = 1800,61641.

Then 1800,61641+150=1950 12 4  $6,002547+250+400=1920 10 3\frac{1}{4}$   $6,002547\times200+650=1850 8 2\frac{1}{2}$  1800 0 0Hence it appears that A's Offer. 150 150 150 150 1800 150 150 150 150

(63) First 54,85—7.35=47,5£. the Annuity.

Now as the Payment is Half-yearly, we shall have u=

475÷2=23,75, t=6, andr=1,01; (see the Guide
p.223.) which raised to the 6th Power = 5,0756921,
per table V.

: 5,0756291  $\times$  23,75=120,54768735=120£.10s. 11 $\frac{1}{2}$ d. the Aniwer.

(64) First 153-50=103 f. for 12 yrs. at 5 per Cent.

Then per Table VI. 1 f. will purchase for 12 yrs. at 5 per Cent. an Annuity of ,1128254 per Annum.

Then ,1128255 × 103=11,6210162=11f. 125. 5d. ad-

. 16f.+11f. 12,5=27f. 12s. 5d. the Answer.

(65) First 44-20=24 f. and 1, 9487171= Amount of 1 f. for 7 Years. = £.250 0 0

Then 1,9487171 $\times$ 24=46,9292104 = 46 18 7

At 10 f. per Annum for 7 Yrs. = 70 0 0

Answer 360 18 7

(66) First 33.3× 50 = 166,8 = 166 £. 135.4d. Value of the Annuity.

Then per Table VI. 1f. for 12 yrs. at 4 per Cent. will purchase, 1065512, per Anoum.

.: 166,6×,106512=177,587=177 £. 115, 82d. the Answer.

(67) First 237-10=227£. the Annuity.

Then the present Worth for 1f. for 4, 12, and 14 Years, is 3,5459505,8, 8632516, and 9,8986409. per Table V.

# 73. SUPERFICIAL MEASURE. EXAMPLES.

### PROBLEM I.

(1)	Multiply by	Ft. , 17 7 6	(ž) Multiply	Ft. 47	8 ° 0 8 4
	Anfwei	105 6		15 381	8 01
		Ft· , ,		6.0	2 8
(3)	Multiply by	7 100	(4) Multiply		7 0 4 8
		3 11 0 62 8 0		43 258	
	Answer		Answer.	301	-
(5)	Mult. 12	8 9 0 0 × 9 6 7	[2018년 1일 1일 일반 : 10 1일 : 10 1	Fi. , 9 11 × 1	
	. 6 114	751344606900	6		80
	Answer 121	6673	Answer, 116	2	2 0

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		7	7.5.							,
(7)	$6$ $\begin{bmatrix} Ft. \\ 64 \end{bmatrix}$		10 14	0	(8)	6 3	Ft.	4 42	0	1100
	16 896	0					5 2 14	2 7 0	3 1 0 0	
<b>A</b> r	wer 945	 ور	3.	6			14 248 .496	٥	0	
1547A 843 174	Fi.	ı ,	,	nin	An	fwer	5229	9	3	

(9)		7	10		0	(io	6	Ft. 474	6874	- M 3- Y
		9					4"	1 30	66	0 0
		1,1				1		13	2 2	28
Answer	107	7	11	8	10		81	2844	400	00
							8	532	00	00

Answer 88557 4 0 1 0 8

#### PROBLEM II.

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- (1) Here AB=14,5, and AC=9.75 Chains, per Fig. 2.
  Then per Theo. 14.5×9,75=141,375=141a. 1r. 20 p.
  the Area required.
- (2) Here AB=AC=245 yds. per Fig. 1. Then 245 × 245=60025 Acres, or yds. : 4840)60025 (12,42=12 A. 1r. 24p.

(3) Here AB=64 ft. 6 inc. and AC = 47 ft. 8 inc. fee Fig. 3.

Then per Problem I. 64 ft. 6 inc. × 47 ft. 8 inc.=3074 • 9)3074 ft. 6 inc. (=341 yds. 5 ft. 6 inc. the Answer.

#### PROBLEM III.

- (4) Here AB=28 and CD=20,5 Chains. See Fig. 4. G. Then per Theo.  $\frac{28 \times 20,5}{2} = 14 \times 20,5 = 287$  Acres.
- (5) Here AB=738, and CD=583 Links.

  Then  $\frac{738 \times 583}{2} = \frac{420254}{2} = 215127$  Links, or 2,15127 Acres.

: As 2,15127: £.:: 1:5,5781 = 5£, 115.  $6d\frac{3}{4}$ . the Answer.

(6) Here  $\frac{a+b+c}{2} = \frac{400+348+312}{2} = \frac{1060}{2} = 530 = s$ .

Then per Rule.  $\begin{cases}
400 = 130 = e. \\
348 = 182 = f.
\end{cases}$ the three Remainders.

: 530×130×182×218=2733676400.

And v2733676400=52284,5 Then 4840)52284,5)10,8=10 acr. 3 r. 8 p. the Answer.

### PROBLEM IV.

(7) Here AC=45, BF=17,25, and DE=14. See Fig. 5. G. Then per Theo.  $\frac{17,25+14}{2} \times 45 = \frac{31,25}{2} \times 45 = 15,625 \times 45 = 703,125$  ft. these  $\div 9 = 78$  yds. 1 ft. 18 inc. the Answer.

(8) Suppose AB=15,6, BC=13,2, CD=10, and AD=

Then per Rule, first  $\frac{15.6+13.2+10+26}{2} = \frac{64.8}{2} = 32.4$ .  $\frac{32.4-15.6\times32.4-13.2\times32.4-10\times32.4-26}{2} = \frac{15.6\times32.4-10\times32.4-26}{2} = \frac{15.6\times32.4-10\times32.4-10\times32.4-26}{2} = \frac{15.6\times32.4-10\times$ 

V 16,8×19,2×22,4×6,4= 1402,42,2016=215,04

Area required. (See Quest. 29, in Algebra.

Or if the Trapezium can be inscribed in a Circle, that is, if the Sum of any two opposite Angles be equal to two right Angles, or 180°; then multiply any two adjacent Sides together, and the other two Sides together, and multiply by the Sum of these Products, half the Sine of the Angle included by either of the Pair of Sides which are multiplied together, fo shall this last Product be the Area.

ADXDC+ABXBCXs+A, or s. C = the Area.

#### EXAMPLE.

If the Sides be AD=4, DC=7.5, AB=6, BC=5.5, and the Angle C=74° 40½.

Therefore the Angle A=180°-74° 40½'=105° 19½'.

Then by Rule 4×6+7.5×5.5 ×,9644229 (s. 74° 401') =31,46429+fq. Feet, the Area.

#### PROBLEM V.

(9) Here AB=48, CD=41,57, and n=5.

Then per Theo.  $\frac{48 \times 41,57 \times 5}{2} = \frac{9976,8}{2} = 4988,4 \text{ ft.}$ 

the Area required.

(10) First the Multipler for an Hexagon is 2,598076 by the Table.

Then per Rule II. thus 2,598076×30×30=2338,2684, the Area.

(11) Here toe Multiplier for an Octagon is 4,828427 by the Table.

Then 4,828427×24×24=2781,173952, the Area.

### PROBLEM VI.

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(12) Thus 3,1416 × 7=21,9912, or rather 22, the Circum. ference required, (per Rule I.)

(13) Thus 22 ÷ 3,1416=7 (nearly) the Diameter, per Rule II.

(14) Thus 3,1416×8000=25132,8 Miles, the Circumference required.

#### PROBLEM VII.

(15) 
$$C = 6,2832, D = \frac{6,2832}{3,1410} = 2.$$

Then per Theo.  $\frac{6.2832}{2} \times \frac{2}{2} = \frac{6.2832}{2} = 3.1416$ , the

Area, (per Rule II.)
(16) First 12×12=144, Square of the Diameter.
Then ,7854×144=113,8976, the Area, (per Rule II.)

#### PROBLEM VIII.

### PROBLEM IX.

(18) Here AC=55, and AB=59; fee Fig. 9.

Then per Theo.  $55 \times \frac{59}{2} = 55 \times 26,5 = 1622,5$ , the Area required.

· in the in the land of

First, by Rule II. p. 181 G. AC - CE = AE =

 $1764 - 144 = 1620 : \sqrt{1620} = 40,249$  (nearly) Rule I. p. 181. AE+2DE=2AD=1019,982+900 =50,2 (nearly)—At; which ×2=80,498 the Base AB; and by Rule 28, p. 181, AE×2DE=2AD= 1619,982+900=2519,982.

.. v2519,932=50,2 (nearly) the Chord of half the

Arch AB, viz. AD.

Therefore  $80,498 \times 6 + 50,2 \times 8 = 482,988 + 401,6 =$ 884,588, Sum of the Product.

 $\cdot \cdot 884,588 \times \frac{30}{1.5} = 884,588 \times 2 = 1769,176.$ 

(20) First, ,7854×18×18=254,4696, the Area of the whole Circle, (per Prob. VII.)

254,4696 = 63,6174, Area of the Quadrant CABD; fee the last Figure.

And  $\frac{9\times9}{2} = \frac{81}{2} = 40,5$ , Area of the Triangle, ABC, (per Prob III.)

Then from 63,6174 take 40,5, remains 23,1174, the Area of the Segment ABD.

### PROBLEM XI.

(21) Here AB=84, CD=75,5, and AC=3,5 fee Fig. 10. Then per Theo.  $\frac{84+72.5}{2} \times 3.5 = \frac{156.5}{2} \times 3.5 = 78.25 \times$ 3.5=273,895, the Area required.

(22) First, 28 7: 22 :: 24: 75,4, which -2=37.7, the

greatest Semicircle AB.

Again, 36 7: 22:: 16: 30,2, which +2=25,1 lesser CD.

Alfo 
$$\frac{24-16}{2} = \frac{8}{2} = 4 = AB$$
; fee Fig. 10.

Then  $\frac{37.7+25.1}{2} \times 4 = \frac{62.8}{2} \times 4 = 31.4 \times 4 = 125.6$ ,

### PROBLEM XII.

(3)

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6d. -

..

(23) Here AB=24, CD=18, and b=,7854. Then per Theo., 7854×24×18=389,2928, the Area.

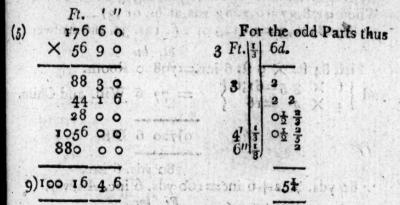
### Of ARTIFICERS WORK.

By Decimals, thus 6,5+5,25+4,75=16,5, Sum of their Heights; which ×4, (the Number of Windows in a Tier)=66 Heights together.

Then  $66 \times 3.75$  (the Breadth) = 247.8 the Area. Now 36d = .08f.  $247.5 \times .06 = 16,499$ , or 16f.

By Decimals, thus 3,25×6,5=21,125 ft. at 8s. or, 4£. .: 21,125×,4=8,45 or £.8 gs. as before.

(4) First 16×2=32 the Length; and 9×3=27 the Breadth Then 32×27=864, square Inches. : 144)864(6 ft. the Content required.



6d. 45 1112 yds. 8 ft. 4 inc. 6sec. at 6d. per Yard.

9) 1079 10

£. 27 16 51 the Answer.

By Decimals, thus 176,5×56,75=10016,375 Feet. Then 9)10016,375(1112,93 yds. at 6d. or, 025£. per yd. "1112,93×,025=27,828, or £.27 16s.5½d. the Answ. as before. Superficial Measure.

(6) 9 6 0 × 8 3	For the odd Parts, thus $3 Ft \cdot \begin{vmatrix} \frac{1}{3} \end{vmatrix} 6s$ .
2 4 6 76 0 0	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
9)78 4 6	6"   0 0 1 3
yds. 8 6 4 6 at 6s.	4 3
2 8 0	en e
0 4 3	

1. 2 12 3 the Answer.

By Decimals, thus 9,5×8,25=78,375 Feet. Then 9)78,375(8,708g yds. at 6s. or ,3£. ... 8,7083×,3=2,6125 or 2£. 12s. 3d. the Answer.

Ft. In.

(7) First 84 ft. × 9 ft. 6 inc.=798 0 Room.

And  $\begin{cases} 6 \times 3.5=61,6 \\ 4 \times 4=16 \end{cases}$  = 77 6 Win. and Chim.

9)720 6 Diff.

80 yds. 6 inc.

.. 80 yds. × 2+6 inc=160 yds. 6 inc. Answer.

Ft. Inc.

(8) First 47 st. 7 inch.—4 st.=43 7 Breadth. ×47 7 Length.

9)2073 10 1

£ . 5 15 2 1 7 the Answer.

(9)

8,6-

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Pl:

Answer £. 2 0 114

Ccz

(13) First 
$$28 \times 20 = 560$$
  
And  $14 \times 10 \times 2 = 280$ } = 280 the Diff.  
1,00)840 Sum.

8,4 fq. at af. 5s. or 2,25f.

.. 2,25×8,4=18,9 or 18£. 18s. the Answer.

$$\begin{cases}
Ft. & \text{Ft.} \\
(14) & 30.5 \times 20.5 \\
5.25 \times 6 \\
4.25 \times 4 \\
8.5 \times 10
\end{cases}$$

$$\times 4 = \begin{cases}
Ft. \\
2501 & \text{Area of the 4 Floors.} \\
126 = \text{dit. of 4 Fire places.} \\
68 = \text{dit. of ditto.} \\
340 = \text{dit. of a Well-hole.}
\end{cases}$$

The whole Deductions = 534

1,00) 19,67 fq. at 8,5£.

.. 19,67×85,=167,195=167f. 35. 103d. the Answer.

(15) First 1,25×15=18,75 Area of one Plank. And 33,5×60,5=2026,75 ditto of the Room. : 18,75)2026,75(10875 Planks (nearly.)

(16) First  $36 + \frac{36}{2} = 36 + 18 = 54$  Width of the Roof.

Then  $64 \times 54 = 3456$  Feet the Area.

And 1,00)34,56(34,56 fqrs. at 125. 6d. or, 625£.

34,56×,625=21,6 or 21£. 125. the Answer.

(17) T

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F

(17) First 30×2=60, and 70×60=4200 st. the Area. Then 1,00)42,00(42 sqr, at 10s. 8d. per sqr.

s. d. 10 8 ×7×6=42.

3 14 8

Answer £.22 8 0

[18] In. Ft. 22,75 | Flat and Half. 10=8 g × 2== 1,6666=Eves Boards.

35,7918 Whole Width. X32,75 Length.

1,00)1172,17708g(11,7217708g fqr. at ,75f.

: 11,72177×,75=8,7913275=8£. 155. 10d. (nearly) the Answer.

(19) First 470 ft. ×9 ft. 6 inc. =4465 ft. And 4465×6 half Brick.=26790.

Then per Rule I. 816)26790(32 rds. 2261 ft. the Answ.

(20) First 840×9=7560 Feet.

× 5 Half Bricks thick.

Per Rule II. 3)37800

Rds. Ft.
272)12600(46 88

Rds. Ft. 46 88 at 4£. 19s. 6d. per Rod. ×4

£. £. s. 184 o at 4£. 46—1 3= 44 17 at 19s. 6d. 68  $\begin{vmatrix} \frac{1}{4} \\ \frac{1}{4} \end{vmatrix}$  1 4  $10\frac{1}{2} = \frac{1}{4}$  of 4£. 19s. 6d. 17  $\begin{vmatrix} \frac{1}{4} \\ \frac{1}{6} \end{vmatrix}$  1 o  $\frac{1}{2}$  nearly.

£. 230 9 11 the Answer.

C,c 3

(4)

(5) T

(6) T

T

(7) T

(8)

(9

A

(21) First 38 -4=9,5 Height of the Gable. And 40+3=13,3

And 40.3—13,3  

$$\begin{array}{c}
4 = 1306,668 \text{ at } 2\\
3 = 980 \text{ at } 1\frac{1}{2}\\
2 = 653,333 \text{ at } 1\\
2 = 116,375 \text{ at } \frac{1}{2}
\end{array}$$
Bricks thick.

816)3056,375(3,74555 Rods.

: 3,745476 × 5,5=20,6 or 20 f. 12s. the Answer.

### QUESTIONS.

(1) First 14 st. 3 inc.=171 inc. and 3 square st.=36×36 =1296 Inches.

: 171)1296(717 Inches, the Answer.

(2) First a Foot square=144 Inches. Then 144-27=5, 3 Inches, Breadth of the first Cut. And 58-5, 3=52, 6 remaining Length.

Also 144 - 52,6=2,734 Breadth of 2d Cut. Then 27-2,734=24,266 remaining Breadth. 144-24,206=5,934 Breadth of 3d Cut.

52,6-5,934=46,732 remaining Length. 144 + 46,732 = 3,0814 Breadth of the 4th Cut. 24,266-3,0814=21,1846 remaining Breadth. 144-21, 1846=6,7974 Breadth of the 5th Cut. 46,732-6,7974=39,9346 remaining Length. 144 - 39,9346=3,6059 Breadth of the 6th Cut. 21,1846-3,6059=17,5787 remaining Breadth. 144 - 17,5787 = 8,1917 Breadth of the 7th Section. 39,9346-8,1917=31,7429 remaining Length. 144 - 31,7429=4,5364 Breadth of the 8th Cut. 17,5787-4,5364=13,0428 remaining Breadth.

144 - 13,0423 == 11,0409 Breadth of the 9th Section. Then 31,7429-11,0409=20,702 remaining Length. Alfo 144 - 20,702=6.956 Breadth of the 10th Section. : 13,0425—6,956=6,0863 Breadth remaining at the last. Q. E. F.

(3) First 10584:6=1764.

The v 1764=42 long Rows.

. 42×6=252 short Rows, 42 in a Row.

(4) First 7×2,5=17,5 Inches, Area of an End. And 17.5×2=35, double Area.

: 35 3=113 Inches deep, the Answer.

(5) First 19×11=209, Area of an End.
Then 209: 4=52,25 Area of an End of the Piece wanting.

.: 52,25:9=5,805 Width required.

(6) First a yd.=36×36=1296 Inches. And 3s. 2d.=38d.

Then as 6d.: 1296 inc. :: 38d.: 8208 inc. Area of

the whole Trough.

Also  $102 \times 21 \times 2 = 4284$  Area of the two Sides.  $\therefore 8208 - 4284 = 3924$  Area of the Bot. and Ends. Then  $102 + 21 \times 2 = 144$ .

: 3924 - 144=274 Inches, the Breadth required.

(7) First 26+40×2=106 Breadth of the Bot. and Sides.

Then 106×74 =7844 Area of Bottom and Sides.

And 40×26×2 =2080 dito of both Ends.

Also 26×16×3 =1248 ditt8 of the Stays.

144)11,72(77,588 fqr. Feet.

28 lb \(\frac{1}{4}\)77,583(19,3958\(g\) cwt. at 225. or 1,1\(\frac{1}{4}\).
\(\cdot\) 19,3958\(g\times\)1.1\(\sim 21\),33541\(\beta\)=21\(\frac{1}{4}\). 65. 8\(\frac{1}{2}\)d. Value of the Ciftern.

Now 3s. 6d.=,175f. Therefore 21,335416-,175=21,160416 Majon's Bill.

7d.=,02916)21,160215(725,5 fq. Feet, Shop.

22 ft. 10 inc.=22,83)725,(31,778=31 ft. 94 Inches, the Answer.

(8) First 27 st. 112 inc.=4000 sqr. Inches.

Then 20×16×2 = 640 Area of the two Ends.

... 20×2+16= 56)3360 ditto of Bot. and Sides.

12)60 Inches.

Answer 5 Feet.

(9) First  $16\frac{1}{2}$  ft. = 5,5 Then  $5.5 \times 5.5 = 30.25$ And  $6 \times 6 = 36$ Also  $7 \times 7 = 49$  I Per. Statute Signal Process of Statute Signal Proc

3x (very lightly from the first the first

Recip. as 30,25: 110:: 36: 92 1 28 Chesh. Measure, 30,25: 110:: 49: 67 3 25 Yorksh. the Ans.

(10) First 7×4=28 sqr. Feet, Area that each Plant takes. : 3584×28=100352 sqr. Feet, in all.

Square Feet in an Acre=43560) 100352(2,303764 or 2 acr. 1 rd. 8\frac{1}{2} pol the Answer.

(11) First 18d .= ,075)100(1333, & Feet, the Area.

Now suppose Fig. 4, in the Guide, to represent the Court,

Then  $133.3 \div \frac{88}{2} = 1333.3 \div 44 = 30.303 = CD$ , the

Perpendicular.

Then 44×44 = 1936 Square of A D, or B D.

Also 30,303×30,303=918,27 Square of D C.

v 2854.27=53,425=AC, or BC.

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And 53,425 × 2=106,85 the Sum required.

(12) Here the last mentioned Fig. may represent the Form of the Bath.

Then 3)125(41, 6=A B or A C.

And 2)41,6(20,8g=A D or B D.

Then 41,8×418 = 1736,07

Also 20,83×20,83=434,025

v1302,052=36,084=D C.

 $\therefore \frac{36,084}{2} \times 41, 6 = 751, 75 = 751\frac{3}{4}$  the Area, per Prob. III.

(13) Square Order. Qu



First 6×6=36 sqr. Feet each in the square Order.

And  $3 \times 3 = 9$ 

Fig. 23.

Avipal Ha

V27=5,19615

Then 5,19615 × 6=31,1769 sqr. Feet each Plant in the Quincunx Order.

Now an Acre=43560 Feet.

. 4356×10=435600 fqr. Feet in 10 Acres.

#### Plants.

Therefore 31,1769(435600(13972 Quincunx } Order.

### Answer 1872

(14) First 10+2½+1=13½ or ½ whole Breath.

Then ½ × ½=3 Feet, Rife of the Roof.

And 13,5÷2=6,75 Half the Width. Alfo 6,75×6,75=45,5625 3×3

V54,5625=7,38664 Length.

Then 13,5 X2 X 7,38664=199,43928 Feet, the Area, at 3 d. or ,014583£. : 199,43928 X 0,1458 2=2,90849 or 2f. 18s. 2d. Anf.

(15) First, as 4,5:8::9 A. to 16 B. And 4:8,5:: 16:34=A's+C's. Then 34-9=25=C's.

: 9+16+25=50=A:s+B's+C's Area.

Now  $\sqrt{9} = 3$  A's,  $\sqrt{26} = 4B$ 's, and  $\sqrt{25} = 5$  C's Side.

Also  $\frac{3+4+5}{2} = \frac{12}{2} = 6$  Poles, the Area of the Triangle.

Therefore 272,25 × 144=39204 Inches in a Pole. X 6 Poles.

> 235224 Inches in fix Poles. 6 Feet= X72 Inches, the Depth.

A gal.=231 inc.)16936128(73316,57 gals.

: 63)73316,57(1163,755=1163 Hhds. 47½ galls. the Answer.

(16) Here suppose Fig. 5, in the Guide to represent the Orchard; which contains 3,75 Acres.

Then A C=the Diagonal; and 430+360=790=BF+ DE. the Sum of the Perpendiculars; half of which is 395 Links, and 3,75 Acres=375000 Links.

: 395)375000(94929 Links=AC, the Diagonal.

Superficial Measure. 298 (17) First 3,1416×16=50,2656 Poles, the Circumference, (per Prob. VI. Rule I.) Then  $\frac{50,2656}{2} \times \frac{16}{2} = 25,1328 \times 8 = 201,0624$  Poles, (per Prob. VII.) the Area. : 160)201,0624(1,2 Acre, the Answer. (18) First 16,5:2=8,25 one Round. : 3,1416)8,2500(2,665 ft. or 3 ft.  $7\frac{1}{2}$  inches, the Anf. (19) First 3,1416)130,0000(41,38 ft. the Diameter. Then  $\frac{41,38}{2} \times \frac{130}{2} = 20,69 \times 65 = 1344,85$ . 9)1344,85(149,428 yds. at 4d or, 018f. .. 149,428×,016=2,490466 or 2f. 9s. 91d.,8, Anfw. (20) First 4840 - 2=2420 yds. half an Acre. Then ,7854)2420(3081, 23 yds. Square of the Diameter, per Prob. VII. Rule II.) ".' V 3081,23=55,5 Diameter. Therefore 55,5 = 2=27,75 or 271 yds. the Answer. (21) First 42+14,5×2=71, greater Diameter. Then 71×71=5041; also 5041×,7854 = 3959,2014 And  $42 \times 42 = 1764$ ; also  $1764 \times ,7854 = 1385,4456$ Diff. of their Areas, are 2573,7538 Then 144)2573,7578(17,8733 ft. at 8d. or 6s. : 17.8733 X, 6=11,9155 or 113. 11d. (nearly the Ans. (22) First, as 3,25 :: 5 : 60 : 92,307 Circumference. . 92,307 ÷ 3,1416=29,38 Diameter. And 29,38 - 2=14,69 Inches, the Answer. Fig. 24. (23) First 86 × 36 × ,7854= 1017,8784, Area of the whole Stone and Spindle-B Hole. Per Prob. Rule II.) And  $5 \times 5 \times 2 = 50$  Square of the Diameter of the Circle, circumferibing the Spindlehole; alfo, 7854×50=39,27 Area of ditto. .. 1017,8784-39,27=978,6 084, Area of the Stone to

be divided.

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Therefore, As 208.: 978,6084 :: \[ 7: 324,5129 A's \] Area. 5: 244,6521 C's

Then 244,6521 + 39,27 = 283,9221, this ÷ ,7854 = 361,5, whose Square Root=19,03 inc. the Diameter

where C begins to grind.

And 285,9221+391,4433=675,3654, this ÷,7854= 859,9, whose Square Root=29,324 inc. the Diameter where B begins to grind.

(24) First 10×10=100; also 100×2=200, Area of the

infide Square.

Then v 200=14,142135 Side of the inscribed Square. Again 20 X 20=400 Area of the circumscribed Square. Lastly ,7854×400=314.16 Area of the circular Section. Hence 314, 16-200=114, 16 Inches, too little. And 400-314,16=85,84 ditto, too much.

25) First 2s. 4d .= ,118f. : 1 ft. :: 10f. : 85,7143 ft. Area of the Semicircle, which X2=171,4286, Area of the whole Circle.

Then ,7854)171,4286(218,269 Square of the Diameter, (per Prob. VII. Rule II.)

.. v218,26=14,7739=14 ft. 91 inc. the Answer.

(26) First ,18 × 18 × 100=32400 French Feet, the Arpent. And 16,5×16,5×160=43560 English Feet, in an Arp. Then 16×16=256; also 15×15=225.

. Recipe 256 : 32400 :: 225 : 36864 English Feet, in

an Arpent.

So that the English Acre is to the Arpent of France, as 43560: 36884, or: 605: 512, nearly 13: 11, or: 1:,84628, the Answer.

(27) First 3,1416×4=12,5664 Circumference of the

Wheel

: 12,5664×5=62,332 by the greater. And 62,832-2=31,416 by the less.

(28) Here (per Prob. IX. Fig. 9 in the Guide) is given CA=30, and AB=63 ft.=21 yds.

and the state of the state of the section of the se

Then per Theo. XXX.  $30 \times \frac{21}{2} = 30 \times 10,5 = 315 \text{ yds.An.}$ 

a (.118 '.16.1 shi) in the value of the late.

300

Superficial Measure.

(29) First 15 Inches=,418 Yards. Then 21-,418=20,583=AB, (Sec Fig. 22.) And 20,58 3 ÷ 2=10,2916=AE. Also 30 × 30 =900=2AC. 10,2918×10,2918=105,92=2AE.

Diff. 794,08=2CE.

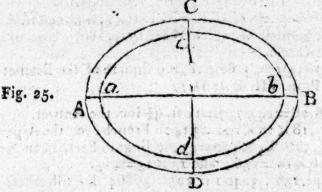
.. \$\square\$794,08=28,18=CE, the Perpendicular.

Then per Prob. X. 30 X = 315, Area of the Sector.

ABCD.

And 10,2918 X 28,18=290,10918, Area of the Triangle.

.. 315-290,01916=24,9808g, Area of the Segment, ABD.



(30) First 14×2=28 Inches; or 2, g Feet. Lin. Ft. Lin. Ft.

Then, as 100: 66:: 840: 554,4=ab. 100:68::612:403,92=cd.

554.4+2.3=556.78=AB.403,92+2, g=406,253=CD; then per Prob. XXVI. 556,78×406,253×,7854=177637,53=Area of ABCD 554,4×403,92×,7854=175877,17=ditto ab ed.

Covered by the Wall. 1760,36 Diff.

Now an Acre=4840 yds. × 9=43560 ft. of what they inclose. (See Prob. XII.) (31 T

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(31First 4 × 10=40 Feet, and 7×7=49 Square Side. Then, as 4: 49:: 40: 490 Square of the Diameter.

.. v490=22,136 Inches, nearly the Diameter required.

(32) First 6×6=36. And 3×3×4×2=72.

Then, 28 36:3:72:6 Hours, the Answer.
(33) First 9×9=81. And 12×122=288. I'hen, as 81 : 22lb. :: 288 : 78 glb. the Answer.

(84) First 1,25×1,25×20=31,25 Feet.

And =,875; then ,875×875×50=38,28125 Feet.

.. As 31,25: 1 Ton, or 1120lb. :: 38,28125 : 1372lb. at 31d. per lb.

### Answer £. 20 00

(35) First 22,5×22,5=506,25. And 22,5×2=45. Alfo 45×45=2025.

Then, as, 506,25: 3 bush. :: 2025: 12 bush. the Anfw.

(36) First 64,3 × 144=9259,2 Square Inches.

And 3=,375: ×9259,2=3472, 2 Solid Inches. Then 3472,2 × 4,38=15151,418 Ounces, which:1792 oz. in t Cwt.)=8,455 Cwt.

. As 19,5 : 21 f. :: 8,455 : 9,10538 or 9f. 25. 14d.648 the Answer.

### 74. MEASUREMENT of SOLIDS.

#### PROBLEM XIII.

(1) Thus 2,5×2,5×2,5=15,625 Feet, the Solidity.

(2) First 57×42×34=81396 Cubic Inches.

A Gal. of Ale=282)81396(288,638 Gal. the Answer.

(3) First 4,5×4,5×,7854=15,90435 Area of the Base (per Prob. VII. Rule II.) Then 15,90435 ×8=127,2348 Feet, the Content req.

### PROBLEM XIV.

(4) Thus 10,5×7,75=81,375, the Surface required. Dd

#### PROBLEM XV.

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(5) First 12×12=144 Area of the Bafe.

Then 144× 25/3=144×8, 3=1200 Feet, the Answer.

(6) Now (per Prob. III, Rule III.) 5,5×3=16,5 Sum of the three Sides, half of which is=8,25.

Then, 8,25-5,5=2,75. Difference.

And 8,25×2,75×2,75×2,75=171,57421875.

Then v171,57421875=13,0986=Area of the Bafe.

.. 13,0986 $\times \frac{90}{3}$  = 13,0986  $\times$  10 = 130,986, the folid Content required.

7 First 3,5 × 3,5 × ,7854=9,62115 Area of the Base, (per Prob. VII, Rule II.)

Then  $9,62115 \times \frac{6}{3} = 9,62115 \times 2 = 19,2423$ , the Solidity required.

#### PROBLEM XVI.

(8) Thus  $\frac{3,25\times20}{2}\times3=\frac{65}{2}\times3=32,5\times3=97,5$ , Area of the three Sides.

Now 3,25  $\times$ 3,25 =10,5625 And 1,625 $\times$ 1,625=2,640625

Diff. 7,921875

 $v \cdot \sqrt{7,921875} = 2,81458$ 

Therefore 3,25×2,81458 = 4,5737 Area of the Base.

Now, 97.5×4,5737=102,0737, the Area required.

(9) Thus  $\frac{45 \times 20}{2} = \frac{900}{2} = 450$  Feet, the Convex Surface required.

### PROBLEM XVII.

(10) First 15 × 15=225=A. And 6 × 6=36=a. Also h=24. Then per Theorem 225 × 36=8100.

And 1/8100=90 the main Prop.

= === +36+90×24/3=351×8=2808 Inches.

Therefore 144)2808(=19,5 Feet, the Solidity.

Or thus, to the Squares of the { Diameters Circumference } of the Ends, adds their Product; multiply the Sum by the Altitude of the Frustrum, & the Product which arises by { ,2618 } ,0265 }

viz. { .7854 } ÷3

And this last Product will be the Content.

(11) Now by the preceding Rule 20 × 20=400.

And 3×3=9. Also 20×3=60, which are the Squares of the Diameters and the Product.

Then 400+9+60=469 their Sum.

.. 469×60=28140, which × ,2618 = 736,7052, the Content.

(12) First 66×66=4356, And 56×56=3136.

Also 66×56=3696, which are the Square of the Circumferences and their Product.

Then 4356+3136+3696=11188, their Sum. ... 11188×4×,0265=1185,928 the Content.

PROBLEM XVIII.

(13) First 3 ft. 4 inc. +2 feet 2 inc. ×4=40+26×4=66 ×4=264 Inches, Sum of the Perimeters.

Then 264 × 10 = 2640 = 1320 Inches.

: 12)1320(=110 Feet, the Surface.

Or thus,  $\frac{3.3+2,1.6\times4\times10=5.5\times4\times10}{2}=220\div2=$ 

1 to Feet.
(14) First 32+8=40, Sum of the Circumference.

Then  $\frac{40\times7}{2} = \frac{280}{2} = 140$  Feet, the Content.

(15) First, as 30: 10:: 6:2, Circumference of the Top of the Frustum.

And 30-6=24 the flant Height.

Then 10+2×24 = 288 = 144 Feet, the Surface required.

#### PROBLEM XIX.

(16) First 30×16× 12 =480×6=2880 ft. the Content.
Dd 2

#### PROBLEM XX.

(17) First 16+36×2=16+72=88, Sum. Then 88×29=1760.

Also 1760× =1760×2=3520 cubic Feet.

#### PROBLEM XXI.

(18) First 16×16=256. And 13×13=169.

Also 16×13=208, which are the Areas of the Ends, and the Product of their Sides.

Then 256+169+208=633 Sum.

.. 633 × 60 = 633 × 20=12660, the Content req.

#### PROBLEM XXII.

(19) First 304×20=6080. And 300×16=4800.

Alfo 304+300×20+16=604×36=21744.

Now 6080+4800+21744,=32624 their Sum.

Then 32624× 5 = 32624×,8 2=27186,8, the Content required.

### PROBLEM XXIII.

(20) First (per Prob. VI.) 3,1416×7=21,9912 the Circumference.

Then 21,9912 × 7=153,9384, the Surface required.

(21) Thus 3,1416×12×12=452,3904, the Surface.
(22) First 7957,75×3,1416=25000,0674 Miles (nearly) the Circumference, (per Prob. VI. Rule I.)

Then 7957,75×25000,0674=198944286,35235 square Miles, the whole Surface required.

(23) First 3,1416 × 42=131,9472 the Circumference. Then 131,9472 × 9=1187,5248 the Surface required.

### PROBLEM XXIV.

(24) Thus 7×7×7×,3236=179,5948, the Solidity required, (per Rule II.)

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(25) First, the Surface is 198944286,35235 Miles, (per Prob. XXIII. (See Ex. 22.)

Then  $198944286,35235 \times \frac{7957.75}{6} = 198944286,35235 \times 1326,291\% = 263858149120,06886875$  Miles, the Solidity required, (per Rule I.)

By Rule II. thus 7957,75) ×,5236=263857624944 the Solidity by this Rule.

The Difference arises by taking the Number, 5236 a little too great.

#### PROBLEM XXV.

(26) First 18=3-4×2=54-8=46. Then 46×4×4×,5236=385,3696, the Content.

#### PROBLEM XXVI.

(27) For an Oblate, thus
,5235×33×55×55=52258, 3875 folid Inches.
Then 1728)52258,3875(30,242+folid Feet.

For an Oblong, thus ,5235×55×33×33=31355,0325 folid Inches.

.. 1728)31335,0325(=18,1452 folid Feet.

#### PROBLEM XXVII.

(28) First, 41888×36×36×39=53743,97952 folid Inc. Then 1728)53743,97952(31,10184 Feet, the Content required.

By Rule II. thus, 7854×36×36=1017,8784. Area of the greatest Circle, (per Prob. VII. Rule II.)

·, 1017,8784×99=100769,9616.

Which -15=6717,99744=15. Therefore 6717,99744×8=53743,97952 folid Inches, as before.

### PROBLEM XXVIII.

(29) By Rule I. Thus, first 42 ÷ 4=10,5 Quarter Girth. And 10,5 × 10,5 × 16=1764 Inches.

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by Rule II. Thus, first,  $42 \div 5 = 8, 4 = \frac{1}{5}$  of the Girth. And  $16 \times 2 = 32$  twice the Length.

Then 8,4×8,4×32=2257,92 Inches.

.. 144)2257,92(15,68 Feet, the true Content.

o) By Rule I. Thus 64:4=16.

(30) By Rule I. Thus 64:4=16. Then 16×16×30,5=7808 Inches.

These: 144, gives 54, 2 Feet, the Content by this Rule. By Rule II. Thus,  $64 \div 5 = 12,8$ . And  $30,5 \times 2 = 61$ . Then  $12,8 \times 61 = 9994,24$  Inches.

:. 144)9994,24(69,4 Feet, (very nearly) the true Con.

tent.

Note, the first Rule differs from the Truth about  $\frac{1}{4}$  of its Contents; that is, when it produces 4 for the Content, it should be above 5. The second Rule is about 5 Times nearer to the Truth than the other, for it differs from the Truth only a Foot in 190; and it is full as easy in Practice, besides it hath in every Respect the Advantage of it. Therefore, I think it ought to be brought into general Use among the Measurers of Timber, who should certainly preser Truth to such gross Errors as are always introduced by the other Method.

(31) First 42×3040=50×400.

Then 144)50400(350 Feet, the Content.

5,0)35,0(7 Tons the Answer.

PROBLEM XXIX.

(32) First, 16 st. 6 inc.=198 inc. and 7 st. 4 inc.=88 ditto.

Then 198 × 88=17424 Area.

Or you may turn or change any Divisor into a Multiplicator, by dividing Unity or 1 by that Divisor.

Thus, 1,000000 ÷ { 282 =,003546 Ale. 231 =,004329 Wine. 268,8=,003722 Corn.

Therefore 1724 X,003546=6,178 Gallons, as before.

(33) First, 58 ft. 6 inc .= 702 Inches.

Then 702×04÷2=65988÷2=32994 Inches Area. : 32994÷282=117 Gallons.

Or thus, 32994×,003546=117 Gallons as before.

(34) First 84,5×50=4225 Area. Then 4225 ÷282=14,9+Gallons. (35) Here by Prob. 3, the Area of the Top is 1772,8, and at the Bottom 4209,727.

Then by Prob. 7th, 4209,727 × 1772,8=7463004,0256, whose square Root=2731,85, the mean Proportion.

Now 2731,85+1772,8+4209,727 × 36 = 8714,377 ×

12=104572,524 Cubic Inches.

: 104572,524 : \ 282=370,824 Ale Gallon. 231=452,6 Wine ditto.

(36) First, by Rule II. 60,5×60,5:359,05=3660,25: 359,05=10,2 Gallons nearly, Area of the Base.

Then by Prob. 15, 10,2  $\times \frac{42,8}{2} = 10,2 \times 14,26 = 145,52$ 

Ale Gallons.

Again 3660.25 - 294,12=12,5.

: 12,5× 42,8 ==178 Wine Gallons.

(37) First by Prob. 7th, 84×84×,7854=5541,7824, Area at the Top.

And 62 × 62 × ,7854=3019,0776 Ditto Bottom.

Now by Prob. 17th, 5541,7824 × 3019,0776 = 16731071,10791424.

V 16731071,10791424=4090,3632 Mean Propor. Then 4090,3632+5541,7824+3019,0776=12651,2232

And 12651,2232×42=22651,2232×14=177117,1248 Cubic Inches, which -282=628,0749 Ale Gallons. By RULE 1.

(38) Thus ,7854×32×32×2=1608,4992 ,7854×26×26 = 580,9304 their Sum =2139,4296 which multiply by 40 =

gives 28525,728 cubic Inc.

: 282) 28525,728(1Q1,155 Ale Gallons. 231)28525,728(123,488 Wine By RULE II.

= 1296=Square of the Head. (39) First 36×36 And  $40 \times 40 \times 2 = 3200 = 2$  Ditto of the Bung. Their Sum

Now 40-36=4. And  $4\times 4=16$ ,  $\frac{2}{5}$  of which =6.4. Then 4496-6, 4=4489, 6.

·· 4489,6×64=287334,4.

Therefore

287334,4+ {,00092837=266,75 Ale ,00113333=325,64+ Wine } Gallons.

Or 1077,157)287334,4(266,75 Ale } Gallons as be.

882,35)287334,4(325,64 Wine } fore.

### QUESTIONS.

- (1) First 6×6×6=216 Solid Inches in ½ a Foot solid. And 2)1728
  - .. 216)364(folid Inches in 1 a folid Foot.

Answer 4 Times as much as the first; or one is 4 of the other.

Ft. In. Ft. In. Ft. In. "

(2) First 25 6×20 2×14 =7199 6 0

==12 9×10-1×7×2=1799 10 6 which is just 4

of the first; or as 4 is to 1, the Answer.

Ft.In. Ft. In. Ft.In. Ft. In. "

(3) First 17 7×13 10×9 6=2310 8 11 And 5 6× 2 1×9 6= 108 10 3

Remains 2201 10 8

Fire-Place, & Windows 27×4=108 0 0

Answer 2309 10 8

(4) First 112,5×32×5,5=19800 in the whole Hold. Also 112,5×4,5×55=2784,375 Gang-Way.

Remaining Concavity, 17015,625

Then 3,3×2,16×3=21,6, Content of 1 Bale.

. 21,6)17015,625(735,3365 Bales, the Answer.

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(5) First a Fodder of Lead=2184 lb. Then 16)2184(136,5 fquare Feet.

. 4,25×8=34 Area of the Bottom.

Also 136,5-34=102,5=Area of the Sides and Ends.

 $8 \times 2 + 4,25 \times 2 = 16 + 8,5 = 24,5$  round.

Then 24,5(102,5(4,183673 Feet, =50,204 Inches.

.: 50,204-,75=49,454 Depth taken at. Now 8 ft.=96 inc. Length, and 4½ ft.=54 inc. Breadth. Therefore 96 × 54 × 49,454 = 242126,7846 cubic Inc.

.. 231)242126,7846(1048,1679 Gallons (nearly) which ÷63=16 Hhds. 40 Galls. (nearly) Answer.

(6) First 18 inc.=1,5 ft. Alfo 14=1,16 ft. Then 1,16×1,5=1,75 Breadth and Depth.

: 1,75)2,5(1,42857 Length of the Piece cut off.

Therefore 18,5-1,42857=17,07143 Feet, the Answer.

(7) First 8,5)126,25(14,853 ft.=2138,8234 Inches, Area of an End.

: 38,5)2138,8234(55,55 Inches deep, the Answer.

(8) First 18,5×18,5×,7854×8=2150,4252 cubic Inches in a Bushel.

Now 7 ft. 10 inc .= 94 inc. Length; 3 ft. 10 inc .= 46 inc. in Breadth; and 4 ft. 2 ine,=50 inc. Depth.

Then 94×46×50=216200 cubic Inches in the Bin. . 2150,4252)216200,0000(100,5 Bush. or 12 qrs. 41

Bush. the Answer.

(9) By the last Question a Bushel=2150,4252 Inches. Then 2150,4252×9=19353,8268 Inches, the Content. : 19353,8268 ÷12=1612,8189 Area of the Circle. Which ÷,7854=2053,49 Square of the Diameter.

And \$\sqrt{2053}\$, 49=45,3 Inches, the Answer.

(10) First 28-2=14 Radius. And 14×14=196.

Also 7×7=49. Then 196-49=147.

Then V147=12,1243557 Perpendicular.

:. 12,1243557 × 7=84,8705, Area of one Triangle. And 84,8705×6=509,223, Area of the Bafe.

Alfo 14×6×134=11256, ditto Sides.

Other Base 509,223

-Yds. Ft. Inc.

A yd,=Inc. 1296)12274,446(9 4 34 Superf.

Alf

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Again 509,223 × 134=68235,88 folid Inches. ... 1728)68235,88(39 folid Feet, 84 Inc. the Answer.

As the Circumference is 44, the Diameter is 14, (per Prob. VI.)

Then  $\frac{44}{2} \times \frac{14}{2} = 22 \times 7 = 154$ , Area of an End, (per-

: 154)5184(33,66 Inches, the Answer.

(12) First 1,25×1,25×,7854=1,2271875, Area of the Circle, (per Prob; VII Rule II.)

And a Pint contains 28,875 cubic Inches.

1,227187)28,875(23,5294 Inches the Answer.

(13) A Bushel contains 2150,4252 cubic Inches, (per Quest. VIII.)
And 13,5×8=108 Bushels in 13\frac{1}{2} qrs.

Then 2156,4252×108=232245,921 cubic Inches.

.. v232245,9216=61,468+, the Answer.

(14) First 20×15×8=2400 cubic Inches in the Stone.

And 290 Tons=649600 lb.

As 220: 2400: 469600: 7086545 Inches.

Then 1728)7086545(4101 Feet the Answer.

(15) A Piece of Timber a Foot long, and 4 Feet round, is a folid Foot, cuft mary Measure:

Also if a Circle be 4 Feet round, its Diameter will be 4:3,1416=1,2732, (per Prob. VI.)

Then a circular piece of Timber 1 Foot in Length, will contain 1,2732 Feet:

Therefore 1,2732×50 (Feet in a Load)=636615 ft. :. 63,6615—50=13,6615 Feet in a Load, the Aniw. (16) Sol. Inc.

 $\begin{array}{ll} 20 \times 20 \times 20 \times \\ & \begin{array}{l} 17854 = 6283, 2 \text{ Cyl.} \\ & 5236 = 4188, 8 \text{ Globe.} \\ & 2618 = 2094, 4 \text{ Cone.} \end{array} \end{array} \begin{array}{l} \text{See Prob.} \\ & \text{XIII. XV.} \\ & \text{and XXIV.} \end{array}$ 

Now if the Diameter of a Circle be 20, the Circumference will be 3,1416×20=62,832. (per Prob VI.)

Also if the Height (C D) of a Cone=20, and the Diameter of the Base A B=20.

Then A D= $\frac{20}{2}$ = 10  $\cdot \cdot \cdot \frac{62,832 \times 10}{2}$  = 314,16 Area

of the Cone's Base. (See Fig. 10 in the Guide.)
Then 20×20+10×10=400+100=500=2 A C.

.. v 500=22,36067614=A C, the flope Side.

Then 314,16 × 2= 628,32 Area of the two Bases. And 62,832×20=1256,64

Cylinders

62,832×20=

1884,96 Superficial Con.

62,832×20=

1256,64 Globe's ditto.

XVI.

and

XXIII.

their Sum =4158,2428 Inches, their Area.

'A Yard=1296:8: 4158,2428: 25,6 or 21. 12d. the Answer.

(17) First 2170×2170×2170×,5236 = 5350308686,8 folid Miles, (per Prob. XXIV.)

Then a Mile=1760×1760×1760=545177600 folid

::5350308686,8×545177600=29168684491287756800 folid Yards in the Moon,

Now in a folid Yard are 36 × 36 × 36 = 46656 folid Incs. Therefore 29168684491287756800 × 46656 = 1360304143625521581260800 folid Inc. in the Moon.

1360394143625521581260800 folid Inc. in the Moon. Then per Quest. VIII. a Quarter = 2150,425 × 8 = 17203,4) 1360894143625521581260800 (7910611528 102128540,06 Quarters of Wheat the Moon would hold if hollow. Q. E. F.

Again 2170×2,1416=6817,272 Circumference of the Moon, (per Prob. VI.)

Then per Prob. XXIII. 6817,272 × 2170=14793480,24
Square Miles, the surface of the Moon.

A mile=1760×1760=3097600 fquare Yards.

: 14793480,25×3097600 = 45824284391424 fquare Yards of Stuff. Q. E. F.

(18) First 7970 + 60 × 2=7970 + 120=8090 Diameter of the Earth and Atmosphere.

Then 7970×7970×7970×,5236=265078559622 fol.

Miles in the Globe of the Earth, (per Prob. XXIII.)

Alfo 8090×8090×8090×,5236=277233177544,4 fol. Miles in the Earth and Atmosphere.

: 277233177544,4-265078559622,8=12154617921,6 folid Miles in the Atmosphere.

And per the last Quest, a Mile=5451776000 folid Yards.
Then

(21

12154617921,6×5451776000=66264254274148761600 folid Yards in the Atmosphere. Q. E. F.

(19) First 30 In.=2,5 Feet.

Then 2,5×2,5=6,25 Area of the Base.

..  $6,25 \times \frac{21}{3} = 6,25, \times 7 = 43,75$  folid Feet, (per Prob. XV.)

Then 21 × 2,5 = 21 × 1,25 = 26,25 Area of one triangular Side, (per Prob. III.)

.. 26,25×4=105 Area of the four Sides.

Now 43,75 at 7s. = 15 6 3 And 105 at 8d. = 3 10 0

Answer Cost 18 6 3

(20) In order to complete the Cone, use this Analogy; as half the Difference of the Top and Bottom are to the Depth, so is half greater Diameter to the Altitude of the whole Cone.

Thus  $\frac{7^{2}-54}{2} = \frac{18}{2} = 9$ . Also  $\frac{7^{2}}{2} = 36$ .

Then 25 9 : 42 :: 36 : 168 Altitude.

... 72×72×,7854× 168 = 228004,7616 Area of the whole Pyramid, (per Prob. XV.)

Again 3 3 = 42 = 1 Altitude of the Piec wanting.

Then 54×54×,7854×42=96189,5088 Area of the Piece wanting.

Therefore 228004.7616 - 96189,5088 = 131815,2528 cubic Inches.

. 282)133815,2528(467 Gals. 3761 pts. the Answer.

(21) First 16+ 16+3,2=19,2 Bottom Diameter.

And 19,2 ×8=153,6 the Height. Also 153,6 ÷3=51,2 cylindrical.

153,6-51,2=102,4 a conical Frustum.

Now 19,2×19,2×,7854=289,529856 Area of the gr. Also 16 ×16 ×,7854=201,0624 ditto lesser Base.

Sum of their Areas 490,592256

Again 289,529856×201,0624=58213,567719, whose square Root=241,274; which added to 490,592256=731,866256.

: 731,866256.  $\times \frac{102,4}{3} = 24981,034874546$  Conical.

And 201,0624×51,2= 10294,39488 Cylinder.

Solid Content of the Pillar 35275,42975 Inches.

.. 1728)35275,42975(20,41988 folid Feet, at 3s. 6d. or

Then 20,41988 ×,175=3,573479 or 3£. 115. 5\(\frac{1}{2}\)d. Anf. Farther

16×3,1416=50,2656 Circumference of the Cylind. 19,2×3,1416=60,3187 ditto Base.

# 2)110,5843(55,29215

Then  $\frac{19,2}{2}$  = 1,6, and 1,6 × 1,6 = 2,56 Also 102,4× 102,4 = 10485.76 their Sum 10488,32

.. V10488,32=102,4125 Slope Height.

Then 102,412 ×55,29215=5662,6534 Con. Superf. Alfo 51,2 × 50,2656 =2573,5987 Cylinder. 289,526 Bottom Area. 201,0624 Top ditto.

their Sum 8726,8405 Inches.

.. 144)8726,8405 (60,8 Feet, the Superficial Content.

(22) First 19,5-13,5=6 Diff. of the Sides. And  $6 \times 6 = 36 \div 3 = 12$  the  $\frac{1}{3}$  of the fq. of their Diff. Now 16 ft. 6 inc .= 198 Inches, the Length. Then 19,5 × 13,5 × 12 × 198=5499,5 cubic Inches. 1728)5499,5(31,539 folid Feet, at 25. 6d. or ,125 f. .. 31,539 ×,125=3,942375 or 3£. 18s. 10d. the Anfw.

= 4247,4432 = 1856 (23) First 3,1416×26×26×2 3,1416×20×20 Sum 5504,0832

Then 5504,0832 × 100 = 183469,44 cubic Inches, (per

Prob. XXIX.)

.. 282)183469,44(650 Ale=2010 Gal. nearly Bar. London Ale. 231)183469,44(794 Brandy. Q. E. F.

(24) First 6 Feet=72 Inches. Then 3,1416 × 72=226,19568, the Circumference. And 226,19568×72=16286,0544 Inches, superficial Content, (per Prob. XXIII.) at 3½d. per Inc.=237£. 10s. 1d. 2, nearly, the Answer.

(25) First 21 × 21 × ,7854=346,3614, Area of the Bafe. Then 346,3614×31=10737,2034 folid Feet. : 10737,2034×1728=18553887.4752 cubic Inches.

231(18553887,4752(80319,8 Gallons.

A Tun=Galls. 252)80319,8(318 Tuns, 183,8 Gallons, the Answer. as in sev Egg. 86porva.

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# 75 SPECIFIC GRAVITY of METALS.

- (1) Thus ,03309446 × 12096=400,3122816 lb. Adv. ÷ 112=3,5742+ Cwt. the Answer.
- (2) First  $\frac{20}{5}$ =4. Also  $4\times 4$ =16 fqr. of  $\frac{1}{5}$  Girth.

And 40 Feet=480 Inches.

Then 480×2×16=15360 cubic Inches, (per Prob. XXVIII. in Mensuration.

By Rule II.,023763×15360=356lb. nearly, or 3 Cwt. 29 lb. the Weight required.

(3) First 7×7×7×,5236=179,5948 folid Inches, (per Prob. XXIV.)

Then 179,5948 × .2580647=46,347 lb. the Answer.

- (4) First 2580647)42,0000000(162.75 the Solidity nearly. Then,5236)162,75(310,828877 Cube of the Diameter, (by Prob. XXIV.)
- .. v310,828877=6,77, the Diameter required.

(5) First 16—6=10, Diameter of the Concavity.

Then 16×16×16×,5236=2144,6656 Cont of the whole
And 10×10×10×,5236=523,6 Content of the Concavity, (per Prob. XXIV.)

Solidity of the Shell.=1621,0656 Inches.

.. 1621,0656 × ,2580647=418,33981b. the Weight req. (6) First 76+5=81, the greater Diameter.

6) First 76+5=81, the greater Diameter.
Also 3 st. 4 inc.=3, 3 the greater Breadth.

. As 81: 3, 3 :: 76: 3,127572, its least Breadth.

Here the Chords and their Arches being nearly equal, in fo fmall a Part of to large a Circle, differs very little from a right Line: the Figure of the Key-stone may be reckoned a Prismoid, and measured accordingly. (See Prob. XXII.)

Now 3, 3 × 4=13, 3. And 3,127572 × 4=12,510288. Also 6,460965 × 8=51,68772' which are the Numbers to be added.

Then 13,3+12,510288+51,68772=7,5313413 Sum.

: 7,5313413 $\times \frac{5}{6} = \frac{3876567}{6} = 64,6094$  folid Feet.

Then 64,6094 × 1728=111645 cubic Inches (nearly.) : 111645 ÷,0929543=12017,4 lb.

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Therefore a Ton = lb. 2240)12017,4(5,3649+ or 1 Ton 5 cwt. 1 qr. 5lb. the Answer.

(7) First 63 × 12 × 12=9072 folid Feet. Then 9072×1728=15676416 cubic Inches. : 15676416×,0977286=1532034,1887lb.

.. And 2240) 153 2034, 1885 (683 Tons, 18 cwt. 98lb. the Answer.

#### CASE II.

(8) First 8 Tons 14 cwt.=19488 lb. Then, 0977286) 19488,0000000 (199409,4 Inches. Now 1728) 199409, 4(115,4 cubic Feet, at 6s. or ,3f. Then 115,4×3=,34,62=34f. 125. 43d. the Answer.

(9) First 1300×4=5200 hhds. and 1 hhd.=282×54= 15228 cubic Inches.

: 15228 × 5200=79185600 cubic Inches, displaced. Then 79185600 × ,037253=2949901 lb. Averd. 2240)2949901(1316 Tons, 18 Cwt. 1 qr. 17lb. the

Weight required.

(16) First 3×3=9 folid Inches in the Gold Chain. Then 9,682625 X 9=89,663 25 its Weight in Air. And 0,527458 × 9=4,747122 wt. of its Bulk of Water.

Weight of the Gold 84,916503 in Water, Q. E. F.

Now a folid Inch of Silver = 5,556769 oz. Troy. Then as 5,556769: 1:: 14,5: 2,6094 inc. of Silver. .. 89,663(625-14.5=75,163625 oz. of Gold. And 9, 962625)75, 163625(7,54456 Space taken up by the 2,6094 dit of Silver. [Gold.

> 10;154 by both: Suin ditto of Gold. 1,514 ditto of Silver.

. 9)1,154,128 z inc. higher. Q. E. F.

Chronology. (11) First 1036)63,00( 6,08108, had it been Gold. Also 5,85)63,00(10,76923, if all Silver. Then by Sect. XXIX. 6,08108 \ 2,54473 10,76923 \ 2,14342 8,2245 Sum 4,68815 4,68815)2,54473(,5428, Part Gold, per oz. 4,68815)2,14342(,4572, Part Silver. oz. dwts. gr. 76. CHRONOLOGY. (1) Thus, 1795:4=448 and 3 remains, so it is the ad Year after Leap Year.

(2) Thus, 1796 -4=449 and o remains, fo it is Leap

Year.

(4) 4)1796 4)1795 (3) 448 449 7)2243 7)2245

320—5 Remains. ... 7—5=2=B. 320-3 Remains. ...7 - 3 = 4 = D.

So C B are the Dominical So D is the Dominical Letters. Letter.

(5) The Dominical Letter (by the last Prob.) is D. And per the Verse, the 1st of May is B, viz. on Friday. Then B 1, B 8, B 15, C 16, D 17, E 18, F 19; fo the 19th of May happens on Tuesday.

(6) The Dominical Letter is B, (per Ex. IV.) - and per

Verse, the 1st of June is E, viz. on Wednesday.

Then E 1, F 2, G3, A4; consequently the 4th of June must be on Saturday.

(7) 1795 28)1804 19)1796 15)1798

Rem. fol. Cyc.=12 lun. Cyc.=10 Indiction=13 in mid to distribute un E e 3 burgl so vana ellis Tallis

1796	1796	1766
9		3
28)1797(64	19)1789(94	15)1791(119

Or I

1

F

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it i

Rem. fol. Cyc.=3 lun. Cyc.=11 Indiction=14

So that 4 and 3 are the folar Cycles, 10 and 11 the lunar Cycles or Golden Numb. and 12 and 14 the Indic Cyc.

(8) The Golden Number is 10 (per last Ex.)

Then 11 × 10=110 which ÷30=3, and 20 remains.

• 20-11=9 the Epact.

(9) The Golden Number is 11, then 11×11=121, which :30=4 and 1 remains. :19+1=20, the Epact.

(10) The Epact is 9, (per Ex. VIII.) Number of the Month 3, and Day of the Month 21.

Then 9+3+21=33, and 33-30=3, the Moon's Age.
Also 30-3=27 after 21st of May, or June 17th, the Day

of the next new Moon.

(11) The Epact 20, (per Ex. 9) the Number of the Month 1, and Day of the Month is 24.

Then 20+1+24=45.

.. 45-30=25 Days is the Moon's Age.

Now 30-25=5 Days after the 24th of March, or the 29th of March is the Day of the next new Moon.

(12) The Dominical Letter is D, (per Prob. IV.)

On the 20th of March the Moon's Age is 30, (by Prob. VI.) fo that the nearest new Moon to March 20th salls on Feb. 12, and the 15th Day of that Moon is Feb. 18.

Now March 1st is D, or Sunday, (per the two Lines Prob. III.) Then Easter Sunday will be on the 5th of April.

(13) The Dominical Letter is B.

And on the 21st of March the Moon's Age is 22, so that the nearest new Moon to March the 21st falls on March 11th, and the 15th Day of that Moon is March 16th.

Now March 1st is D, consequently Easter Sunday will be on the 27th of March; from which the other moveable Feasts may be found.

Or by knowing what Day of the Month Shreve Sunday is

on, all the rest may be found.

Shrove Sunday is always the first Sunday after the second Change of the Moon, which happeneth after New-Year's Day: and if that Day of the fecond Change be Sunday, then that Sunday is Shrove Sunday.

#### XAMP L

What Day of the Month is Shrove Sunday in the Year 1786, being Feb. 24th.

First the Moon's Age is 14 Days old\*, (per Prob. VI.) Then by running back, I find the Day of her second

Change will be Feb. 10th.

Now by the Lines in Prob. III. the first of Feb. is D. or Wednesday, as the Dominical Letter is A. (per Prob.

Therefore D being the first, D is 8, E 9, F 10, G 11, A 12; fo that Shrove Sunday will be on Feb. 26th. being the first Sunday after the fecond Change.

Now Shrove Sunday being found as above, Feb. 26th.

Quadragessima, or the first Sunday in Lent, April 5. must be Easter Day being 7 Weeks after Shrove-Sunday, must be Easter Term, beginning a Fortnight after May 3. Easter Wednesday, must be Rogation Sunday, being 6 Weeks after May 21. Easter Wednesday, must be . Ascension Day, being 3,9 Days after Easter must be

Easter Term, ends the Monday after Ascen- May 29.

fion Day. Whit Sunday, is 7 Weeks after Easter, must } June 4.

Trinity Sunday, the next after Whit Sunday June 11. must be

<sup>\*</sup> In this Case the Epact must always be used for the Year before; as it is for 1785, use the Epact for 1785, which is 18, (per Prov. V.)

320		wogy.		
Trinity Term Sunday.	, begins Fri	day after	Trinity-	June 16.
Trinity Term afterwards.	, ends Wed	nelday F	ortnight }	July 3.
And the Begin Terms are	fixed.			
	ore Shrove Su	nday.		
	whether befo	re or afte	r it.	
Epiphany is reit is always	the 6th of Ja	ng the m nuary.	oveable I	feasts; but
(14) 3 Moon	's Age.	(15)	25 Moor	r's Age.
5)12	The call in	5)	100	
2 hrs. 2	4 m. after Mi	idday.	20	
		_	12	
			m.	Midnight.
(16) Per Ex. IV. At London			24 p. m. l	D.
Anfwer 24 Mi	in. past 5 at 1	Sum 5 Night.	24	
				h. m.
(17) The Moon At Briftol Key		v S. and V	W. by N.	8 af. M.N. 6 45

(17) The Moon fouths at
At Bristol Key p bares E. by S. and W. by N. 6 45

Sum 14 45

Answer 45 Min. past 2 M.

### QUESTIONS.

(1) In the Reign of William I. were 5 intercalary Days, (by Prob. I.)

Between Sept. 9 and Oct. 4, are 25 Days.

And 1087 | 1066=21 yrs. wanting 25 Days.

Then 21×365+5-25=1645 Days, William I. reigned.

In the Reign of William Rufus were 4 intercalary Days. Between August 9, and Sept. 9, are 38 Days.

And 1000—1087=13 yrs. all but 38 Days.

Then 365 × 13-38+4=4711 Days, William II. reigned. Lastly, in the Reign of William III. were 3 intercalary Days.

From Feb. 3 to March 8, are 33 Days.

And 1701-1689=12 Years, and 33 Days.

Then 365×12+33+3=4416 Days, Will. III reigned.

(2) In the Reign of Richard I. were two intercalary Days.

Between April 6, and July 7 are 92 Days.

And 1399—1189=10 yrs. wanting 92 Days.

Then 365 × 10+2-92=3560 Days, Richard I. reigned. In the Reign of Richard II. were 5 intercalary Days. From June 21, to Sept. 30, are 101 Days.

And 1399-1377=22 Years and 101 Days he reigned.

Then 365×22+101+5=8136 Days Rich. II. reigned. In the Reign of Richard III. was 1 intercalary Day. From June 18, to August 22, are 65 Days.

And 1485-1483=2 yrs. and 65 Days he reigned. Then  $365\times2+65+1=796$  Days, Richard III. reigned. Therefore 3660+8136+796=12492 Days, the Answer.

(3) In the Reign of Queen Mary, were only 1 intercalary Day.

But from 1553 till 1602, were 12 intercalary Days.

So that in the Reign of Q. Elizabeth, were 11 intercalary Days.

From July 8, to Nov. being 4mo. 9d. are 132 Days.

Then 365×5+132+1=1958 Days, Mary reigned.

Now 1602-1553=49 Years.

And from March 14, to July 8, are 115 Days.

Also 365-115=250 Days.

Then 365×49+250+12=18147 Days, to the Beginning of James's Reign.

18147-1958=16189 Days, Elizabeth reigned. In the Reign of James I. were 6 intercalary Days.

From March 14, to the 27th is 13 Days.

And 1625—1802=23 Years, but the Date altering at our Lady Day, so that the intercal. was only 22 Years.

Therefore 365 x 22+13+6=8049 Days James I. reigned.

In the Reign of Charles I. were 6 intercalary Days. From March 27, to Jan. 30, are 309 Days.

And 1648-1625=23 Years.

Then 365 × 23 + 309 + 6=8710 Days Charles I reigned. .. 16189+8049+8710=32948 Days the Answer.

(9) 3

(10)

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(12)

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(17) (18)

(19)

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(21)

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(23)

(24) (25)

(26)

(27) (28)

(1

(2, 3

(5)

(6)

(4) The Grant begun Decemb. 14th. 1109, and resumed Nov. 19th. 1219.

From Nov. 19, to Dec. 14, are 25 Days.

And 1219-1109=100 Years, wanting 25 Days.

In which Time are 27 intercalary Days.

Then 365 × 110 +27-25=40152 Days, the first Gon. tinuance.

The fecond Grant revived July 16th, 1497, and ended May 10th, 1524.

Then from May 10, to July 16, are 67 Days.

And 1524-1497=27 Years, wanting 67 Days, in which Time there are 7 intercalary Days.

Therefore 365 × 27+7-67=9795 Days, last in Force. : 40152-9795=49947 Days, the Grant was in Force.

The first Grant resumed Nov. 19th, 1219, and revived July 16th, 1498.

From Nov. 19, to July 16, are 239 Days.

And 365-239=126 Days.

And 305-239=120 Days. Also 1498-1219=279 Years, wanting 126 Days; in which Period are 69 intercalary Days.

Therefore 365×279+69-126=101778 Days, superfeded. Q. E. F.

#### 77. GEOGRAPHY.

(1) Lat. 39° 54" N. 57 S. and Long. 11 6°. 28 E.

(2) Jamaica and Cape of Good Hope.

(3) Diff. 10° 30' and 48".

(4) 4691 Miles, Buda, in Hungary, Madrid, &c.

(5) Decl. 19° 15'N. Right Asc. 60° 45', Mer. Alt. 57°

(6) R. 20' P. 4. sets 37' P. 7, Amp. 30° N. Twil. beg. 21' P. 1, ends 30' P. 10.

(7) Azm. 78° from the N. Alt. 12° 30'.

(8) Port Royal bears W. from London, and London bears N. E. from Port Royal.

- (9) 30' P. 7, P. M. at Pekin, Breakfast at Port Royal, Dinner at Rome, and Supper at the Ladrone Isles.
- (10) Antigua, Pagan, one of the Ladrone Isles, &c.
- (11) May 10th, and Sept. 2d.
- (12) All those Places whose Lat. is equal to 72° 45' N.
- (13) Begins May 4th, and leaves them Aug. 9th, following.
- (14) Rifing to N. Mexico, Ter. Fuego, &c. fetting to Capdy in the Isle of Ceylon, and Part of Asia, &c. Noon at Porto, St. Vincent, &c.
- (16) Begin in N. and S. America, the S. and Pacific Seas, Part of Tartary, the Land of Jesso, &c. Mid. All the great S. Sea, the E. and W. Indies, Part of Asia, &c. End all Asia, and the East Indies, New Holland, the S. Sea, Part of N. America, &c.
- (17) 63°, (nearly.)
- (18) Antoeci, Part of the S. Ocean, Peri, Part of the great Pacific Ocean, Antip. Part of the New Zealand, or Part of the S. Ocean.
- (19) Sun's Declination 23°.
- (20) Sun's Place 21.30. 8. Right Afcention 29° E.
- (21) Rises 51. Sets 61. Amp. 3° N.
- (22) Altitude 44° 30'. Azimuth 43 E.
- (23) Hour 74. Azimuth 76½.
  (24) Course 60°. Distance sailed 41°. 2460 Miles.
- (25) Diff. of Long. 40°. Diftance failed 63°. or 3780 Miles.
- (26) Diff. of Long. 18.°. Course 41°.
- (27) Diff. of Lat. 23° 30'. Distance sailed 39°. or 2340 M. (28) Diff. of Lat. 29° 30. Long. 19°.

#### CELESTIAL GLOBE.

- (1) At \(\frac{3}{4}\) p, \(\frac{3}{5}\), fets 20' p. 4, no Night.
- (2, 3, 4,) For these Examples, the best will be to answer them for the Year you are in; as you will then (by the Ephemeries) have it in your Power to find the Node of the Moon, and her Place at Noon, likewife the Places of any of the Planets.
- (5) Decl. 29° N. Right Asc. 112, Lat. 6° 30', Long 90° 45 Leo.
- (6) Aldabaran rifes at 1 A. M. fets at 4 P. M. comes to the Mer. 4 p. 8, Amp. 26°. N.

### Algebra.

R. cosmically Sept. 24th, fets July 6th.

(8) R. acronically Jan. 25th, fets December 18th.

Jan. 13th. (9) (10) Nov. 16th.

(11) Obl. Decl. 120°, continues above the Horiz. 9 hrs.

(12) Azim. 10°, from the N. Alt. 8°.

(13)  $\frac{3}{4}$  p. 8.

(14) 14° 30' N.

(15) 7' p. 12.

(16) ‡ p. 3, A. M.

(17) Lat. 44° 30' N. (18) Lat. 22° 30' N. (19) 44° 30' S.

(20) Arctures on the Mer. nearly, Canis Minor fetting, and the Stars Lyra, Altayr, Cor Hydræ, Cor Leonis, Castr. Capella, &c. will be visible.

(21) Lat. 3° 30', Long. 26° 36' of 20, and Lat. 25° S. Long. 12° 30' mg.

(22) R. 3 h. 45 m. A. M. Amp. 14°, fet 2 h. 25 m. P. M.

Decl. 9° 15' S. Right Afc. 227° 30'.

(23) Through the Tail of Capricorn, the Head of Indus, the Neck and Body of Pavo, the Neck of Apus, Tail of Centaurus, between the two Stars in the Back of Hydra, and then to the Ecliptic near Cor Leonis: Velocity 4° i per Day.

#### ALGEBRA.

#### ADDITION. 78.

#### EXAMPLES.

To 
$$6a+7b-3c$$
  $ab-6b+4x+10y-15z+6$   
Add  $10a+b-7c$   $6ab-b+x+4y-9z+3$   
Sum  $16a+8b-10c$   $7ab-7b+5x+14y-24z+9$ 

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To Add

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Fron Tak

Rem

To 
$$-6b-7c-8x$$
  $6a-6x+7y-10$ 
Add  $4b+9c+5x$   $-6a+6x-4y+13$ 

Sum  $-2b+2c-3x$  \* \* \* 3y+3

To  $4a+6b+4c-6$   $2a-6bc$ 
 $4x-7y+4z$   $2a-6bc-6x+10$ 

Sum  $4a+6b+4c-6+4x-7y+4z$   $2a-6bc-6x+10$ 

To  $10a \lor bc$   $a \lor bb+cc$   $b+3 \lor aa-a$ 
Add  $6a \lor bc$   $4a \lor bb+cc$   $b-3 \lor aa-a$ 

Sum  $16a \lor bc$   $5a \lor bb+cc$   $2b$  \* \*

#### 80. SUBTRACTION.

#### EXAMPLES.

From 3a 2a-4x+7y-7 6b-4c+4x
Take-3a 6a+4x+7y+4 7b+7c-9x

Rem. 6a -4a-8x \*\*-11 -b-11c+13x

From 10a 
$$\lor$$
 bc 6b  $\lor$  ca+xx a+b
Take 6a  $\lor$  bc 4b  $\lor$  aa+xx a- $\lor$  cc-aa

Rem. 4a $\lor$  bc 2b  $\lor$  aa+xx \*\*+b+ $\lor$  cc-aa

### 81. MULTIPLICATION.

### EXAMPLES in CASE I.

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Mul. 
$$a+c$$
  $-a-b-c$   $x+y+z$ 

by  $b$   $-d$   $a$ 

Prod.  $ab+bc$   $ad+bd+dc$   $ax+ay+az$ 

Mul.  $-8x$   $12x+6y$ 

by  $-4a$   $4a$ 

Prod.  $32ax$   $48ax+24ay$ 

Mul.  $-6d$   $4x-5y+z$ 

by  $-6f$ 

Prod.  $-42bd$   $-24fx+30fy-6fz$ 

Mul.  $2a-4b$   $aa-b$ 
 $4aa-8ab$   $aab-abb-bbb$ 

Prod.  $4aa * -16bb$   $aaa * * -bbb$ 

(10) Mul.  $ax-ax$  by  $a+x$ 
 $axx-aax$   $axx-axx$ 

Prod.

xxx-axx \*

Mul. 
$$xx+xy+yy$$
  
by  $xx-xy+yy$   
 $x^4+x^3y+x^2y^2$   
 $-x^3y-x^2y^2+xy^3$   
 $x^2y^2+xy^3+y^4$   
Prod.  $x^4 + x^2y^2y + y^4$ 

M. 
$$aaa = 3aab + 3ab^2 = bbb$$
  
by  $aa = 2ab + bb$ 

$$\begin{array}{r}
a^{5} - 3a^{4}b + 3a^{3}b^{2} - a^{2}b^{3} \\
-2a^{4}b + 6a^{3}b^{2} - 6a^{2}b^{3} + 2ab^{4} \\
a^{3}b^{2} - 3a^{2}b^{3} + 3ab^{4} - a^{5}
\end{array}$$
P. 
$$\begin{array}{r}
a^{5} - 5a^{4}b + 9a^{3}b^{2} - a^{2}b^{3} + 0 + 5ab^{4} - b^{5}
\end{array}$$

Mul. 
$$\sqrt{bc+dcc}$$
  $\sqrt{xx+zz}$   $6cd\sqrt{b}+ad$   
by  $\sqrt{ac}$   $\sqrt{xx-zz}$   $3a\sqrt{ca}$   
Prod.  $\sqrt{abcc+adccc}$   $\sqrt{x^4-z^4}$   $18acd\sqrt{abc-aadc}$ 

#### 82. DIVISION. EXAMPLES in CASE

(1) 
$$d)ad+6d(a+6)$$
 (2)  $-d)-ad-bd(a+b)$   
(3)  $a)aa+ab(a+b)$  (4)  $-a)ab(-b)$ 

(5) b)—ab—bd(—a—d

(6) -bc)abc+bcd+bcf(-2-d-f 7b)42db(6d (8) 2bx)8abx-18bxc(4a-9c

(9)  $2b+bb=\frac{ab-bb}{2b}=\frac{a-b}{2}$ , here Unity, or 1b is the common Measure. (See Sect. XXXVIII. Case I.)

(10)  $20a)10ab+15ac = \frac{10ab+15ac}{20a} = \frac{2b+3c}{4a}$ , here 5 is the common Measure.

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(12) 
$$a+b$$
) $aa+2ab+bb$ ( $a+b$ )  $aa+ab$ 

$$(13) \qquad e+b)aa-bb(a-b)aa+ab$$

nominates silv

It often happens that the Operation may be continued without End, as in the last Example, and then you have an infinite Series for the Quotient; but by comparing the first three or four Terms you may find what Law the Terms observe: by which Means, without any more Divisor, you may continue the Quotient as far as you please.

Thus, the last Example may be continued as far as you please, by adding the Power of a.

$$3x^{2}-4x+5)18x^{4}-45x^{3}+82x^{2}-67x+40(6x^{2}-7x-8)$$

$$18x^{4}-24x^{3}+30x^{2}$$

$$-21x^{3}+52x^{2}-67x$$

$$-21x^{3}-28x^{2}-35x$$

$$-24x^{2}-32x+40$$

$$-24x^{2}-32x+40$$

$$\begin{array}{c}
(16) \\
4x-5a)48x^3-76rx^2-64a^2x+105a^3(12x^2-4ax-21a^2) \\
48x^3-60ax^2 \\
& -16ax^2-64a^2x \\
& -16ax^2+20a^2x
\end{array}$$

$$\begin{array}{c}
-84a^2x+105a^3 \\
-84a^2x+105a^3
\end{array}$$

Ff3 -1-1-1-22 dT (4)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

$$3x+4a)81x * -256a^{4}(27x^{2}-36ax^{2}+48a^{2}x-64a^{3})$$

$$81x^{4}+108ax^{3}$$

$$108ax^{3}-144a^{2}x$$

$$144a^{2}x$$

$$144a^{2}x+192a^{3}x$$

$$-192a^{3}x-256a^{4}$$

$$192a^{3}x-256a^{4}$$

(18)2x-3a) $16x^4$   $+ 72a^2x^2$   $+ 8a^4$ ( $18x^3 + 12ax^2 - 18x^2s - 27a^3$  $16x^4 - 24ax^3$ 

$$\begin{array}{c}
** -24ax^3 -72a^2x^2 \\
24ax^3 -36a^2x^2 \\
** 36a^2x^2 \\
36a^2x^2 +54a^3x
\end{array}$$

$$\begin{array}{c}
** -54a^3x +81a^4 \\
54a^3x +81a^4
\end{array}$$

(19) 2xyvz)4xyvxzz(2vxz the Quotient.

(20) 20 V2cy (60ab V10acxy (3ab V5ax the Quotient.

(21) x2)x5 (x3 the Quotient.

(22) a+x 4a+x (a+x17 the Quotient.

## 83. FRACTIONS.

(1) Thus 
$$a-x+\frac{a^2-ax}{x} = \frac{ax-xx+a^2+ax}{x} = \frac{a^2-x^2}{x}$$
 (by Sect. XXXVIII. Cafe III.

(2) Thus 
$$a+b+\frac{x}{z}=\frac{az+bz+x}{z}$$
.

(3) Thus 
$$a-x+\frac{aa-ax}{x} = \frac{ax-xx+aa-ax}{x} = \frac{aa-xx}{x}$$

(4) Thus 
$$\frac{a^2-x^2}{x} = -x + \frac{a^2}{x}$$
.

(5) Thus 
$$\frac{az+bz+x}{z} = a+b+\frac{x}{z}$$
.

(6) Thus 
$$\frac{ax - xx + aa - ax}{x} = -x + \frac{aa}{x}$$

(7) Thus 
$$\frac{a}{b}$$
,  $\frac{c}{d}$ ,  $\frac{e}{f}$ ,  $=\frac{adf}{baf}$ ,  $\frac{cbf}{baf}$ , and  $\frac{edb}{bdf}$ .

(7) Thus 
$$\frac{a}{b}$$
,  $\frac{c}{d}$ ,  $\frac{e}{f}$ ,  $\frac{adf}{baf}$ ,  $\frac{cbf}{baf}$ , and  $\frac{edb}{bdf}$ .

(8) Thus  $\frac{b+t}{a+b}$  and  $\frac{d-c}{b-d} = \frac{bb-bd}{ab-ad+bb-bd}$  and  $\frac{ad-ac+bd-bc}{ab-ad+bb-bd}$  and

(9) First 
$$a^2+ab+b^2$$
  $a^3+2a^2b+ab^2$  (a

Rem. 
$$-2a^{2}b-2ab^{2})a^{2}+2ab+b^{2}(\frac{1}{2b}\frac{1}{2a}\frac{1}{2a}\frac{1}{ab+b^{2}}\frac{ab+b^{2}}{ab+b^{2}}$$

Hence it appears that -2a2b-2ab2, is the common Measure; by which a3-2b2, being divided.

viz. 
$$-2a^2-2b^2$$
) $a^3-\frac{4}{2a}-ab^2$ ( $\frac{b}{2b}\times\frac{1}{2}$ )
$$-a^2b-ab^2$$

$$2ab-ab^2$$

Then 
$$\frac{a}{2b} + \frac{1}{2} = \frac{-a+b}{2ba}$$
, the new Numerator.

And 
$$\frac{1}{2b}$$
  $\frac{1}{2a}$   $\frac{-a-b}{2ba}$ , the Denominator.

Let both be  $\times 2ba$ , and we shall have  $\frac{-a+b}{-a-b}$  New N.

(2)

(3)

(4)

(1)

(2)

(3)

Or change the Signs of all the Quantities, it will be  $\frac{a^2-ab}{a+b}$ , the new Fraction required.

That is 
$$\frac{a_2-a_b}{a+b} = \frac{a^3-ab^2}{a^2+2ab+b^2}$$
.
the common Measure.

(10) Thus  $\frac{25az}{5xz+15az} = \frac{.5a}{x+3a}$ , by expunging z, and

dividing by 5.

Also  $\frac{a^3+b^3}{a^2-a^2} = \frac{a^2-ab+b^2}{a-b}$ , by dividing by a+b, the common Meafure.

## ADDITION.

### EXAMPLES.

- (1) Thus  $\frac{a}{b} + \frac{c}{d} + \frac{d}{c} = \frac{ade + bce + ddb}{bde}$ , the Sum.
- (2) Thus  $\frac{a-b+d}{d+a} + \frac{a+b-d}{d+a} = \frac{2a}{a+d}$ , their Sum. (3) Thus  $\frac{2a-b}{a+c} + \frac{2b-a}{a+c} = \frac{a+b}{c+a}$ , the Sum. (4) Thus  $\frac{a+b}{d} + \frac{2a+c}{d} = \frac{3a+b+c}{d}$ , the Sum.

### SUBTRACTION. EXAMPLES.

(1) Thus  $\frac{x}{2} = \frac{3x}{6} = \frac{2x}{6} = \frac{x}{6}$ , the Difference.

(2) Thus 
$$\frac{a+x}{b} = \frac{a-x}{c} = \frac{ac+ex}{bc} = \frac{ab-bx}{bc} = \frac{ac+cx-ab+bx}{bc}$$
, the Difference.

(3) Thus 
$$\frac{b^2+a^2}{c} = \frac{b^2}{c}$$
, the Difference.

(4) Thus 
$$\frac{2b}{a+d} = \frac{a+b-d}{a+d} = \frac{b-a+d}{a+d}$$
, the Diff.

# MULTIPLICATION.

### EXAMPLES.

(1) Thus 
$$\frac{a+b}{c} \times \frac{a-b}{d} = \frac{a^2-b^2}{ed}$$
, the Product.

(2) Thus 
$$a + \frac{b}{c} \times \frac{d}{c} \times \frac{ac+b}{c} = \frac{d}{c} \times \frac{acd + bd}{cc}$$
, the Product.

(3) Thus 
$$\frac{3a-2b}{2d+c} \times \frac{4a+2b}{d} = \frac{12a^2-2ab-4b^2}{2dd+dc}$$
, the Product.

(4) Thus 
$$2a + \frac{b}{c} = 25 \times 36 + 4c = \frac{2ac + b - 25c}{c} \times \frac{36 + 4c}{6} = \frac{6bac + 3b^2 - 75bc + 8ac^2 + 4bc - 100c^2}{c} = \frac{6ba - 71b - 8ac - 100c + \frac{3be^2}{c}}{c}$$
, the Product.

### DIVISION.

## EXAMPLES.

(1) Thus 
$$\frac{acd+bd}{cd} \cdot \frac{d-acde+bde}{cdd}$$
, or  $\frac{ac+be}{cd}$ , the Quotient.

(2) Thus 
$$\frac{a-b}{a} \div \frac{a+b}{a-b} = \frac{a^2-2a^5+b^2}{a^2+ba}$$
, the Quot.

(3) Thus 
$$a + \frac{b}{c} \div d + \frac{e}{f} = \frac{ac - b}{c} \div \frac{fd + e}{f} = \frac{fa - bf}{fac + ce}$$
, the Quotient.

(4) Thus 
$$\frac{ab}{c} \div \frac{1}{c} = ab$$
, the Quotient.

#### 70. INVOLUTION.

(6)

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(1) Thus the fourth Power of 
$$x=x^{4}$$
.

(2) The fifth Power of 
$$ax+z$$
)2= $ax+z$ 1.0.

(4) The fixth Power of 
$$\frac{5ab}{2c} = \frac{15625ab^6}{64c}$$
,

(5) Thus 
$$a+b$$

$$a+b$$

$$aa+ab$$
 $ab+bb$ 

$$a^3 + 2a^2b + ab^2$$
 $a^2b + 2ab^2 + b^3$ 

$$a_3+3a^2b+3ab^2+b^3=$$
 the Cube, or third Power.

$$a^4 + 3a^3b + 3a^2b^2 \times ab^3$$
  
 $a^3b + 3a^2b^2 + 3ab^3 + b^4$ 

$$a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$$
, the fourth Power.

$$a^{5} + 4a^{2}b + 6a^{3}b^{2} + 4a^{2}b^{3} + ab^{4}$$

$$a^{4}b + 4a^{3}b^{2} + 6a^{2}b^{3} + 4ab^{4} + b^{5}$$

a55a4b+10a3b2+10a2b3+5ab4+b5, the 5th Power.

$$\frac{a+b}{a^{6}+5a^{5}b+10a^{4}b^{2}+10a^{3}b^{3}+5a^{2}b^{4}+ab^{5}}$$

$$\frac{ab+5a^{4}b^{2}+10a^{3}b^{3}+10a^{2}b^{4}+5a^{5}b+b^{6}}{a^{6}+6a^{5}b+15a^{4}b^{2}+20a^{3}b^{3}+15a^{2}b^{4}+6ab^{5}+b^{6}}=6thP.$$
(6) Thus
$$\frac{a-b}{a^{2}-ab}$$

$$\frac{a^{2}-ab}{ab+b^{2}}$$

$$\frac{a^{2}-ab+b^{2}}{a^{3}-2a^{2}b+ab^{2}-b^{3}}$$

$$\frac{a^{3}-2a^{2}b+ab^{2}-b^{3}}{a^{3}-3a^{2}b+3ab^{2}-b^{3}}, \text{ third Term.}$$

$$\frac{a-b}{a^{3}b+3a^{2}b^{2}-3ab^{3}+b^{4}}$$

$$\frac{a^{4}-4a^{3}b+6a^{2}b^{2}-4ab^{3}+b^{4}}{a^{4}-4a^{3}b+6a^{2}b^{2}-4ab^{3}+b^{4}}, \text{ fourth Power.}$$

$$\frac{a-4a^{4}b+6a^{3}b^{2}-4a^{2}b^{3}+ab^{4}}{a^{4}b+4a^{3}b^{2}-6a^{2}b^{3}+4ab^{4}-b^{5}}$$

$$\frac{a^{9}-5a4b+10a^{3}b^{2}-10a^{3}b^{2}+5a^{2}b^{4}-ab^{5}}{a^{9}-5a^{5}b+5a^{4}b^{2}-10a^{3}b^{3}+10a^{2}b^{4}-ab^{5}}$$

$$\frac{a^{6}-5a^{5}b+10a^{4}b^{2}-10a^{3}b^{3}+10a^{2}b^{4}-ab^{5}}{a^{6}-a^{5}b+5a^{4}b^{2}-10a^{3}b^{3}+15a^{2}b^{4}-6ab^{5}+b^{6}=6th P.$$

These Examples are performed by the Theorem as follows: Here, m, Index of the proposed Power, being 6; the first Term am, or the general Expression is equal to a<sup>6</sup>; the fecond  $ma^{m-1}b = 6a^5b$ ; the third  $\frac{m \times m - 1}{1} \times \frac{m - 2}{a b}$   $= 15a^4b^2$ ; the fourth  $\frac{m \times m - 1 \times m - 2}{1} \times \frac{m}{a} \times \frac{m}{a} = \frac{3}{b} = \frac{3}{a}$   $= 20a^3b^3$ ; the fifth  $\frac{m \times m - 1 \times m \times m \times m - 2}{1} \times \frac{m}{a} \times \frac{m}{a} = \frac{3}{b} = \frac{3}{a} \times \frac{m}{a} = \frac{3$ 

Therefore the fixth Power of  $a+b=a^6+6a^5b+15a^4b^2+20a^3b^3+15a^2b^4+6ab^5+b^6$ , as before.

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71. EVOLUTION.

(1)  $x^2+2xy+y^2(x+y)$ , the Root required. 1x)2xy  $x^2+2xy+y^2$ =fecond Power of x+y

\* \* \*

Or thus by Sect. 52.  $x^2+2xy+y^2(x+y \text{ Root as before.}$ 

(2)  $x^{2} - 2xy + y^{2}(x - y)$ , the Root.

 $2x-y = -2xy+y^2$  $-2xy+y^2$ 

(3)  $4^4 - 2x^3y + 3x^2y^2 - 2xy^2 + y^4(x^2 - xy + y^2)$ , the Rt.

Gg

For 
$$120 \times 7$$
  $8 = 5 = -\frac{120 \times 9}{10} = 8 = 100$ .

(5) Given  $\frac{5x}{9} = 74 - \frac{7x}{12}$ 

Then by multiplying both fides of the Equation by 9, and 12, we shall have 60x-364=7992-63x.

Therefore 123x=7992+864=8856, and  $x=8856\div 123=72$ .

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(6) Given  $56 - \frac{3x}{4} = 48 - \frac{5x}{8}$ Then 1792 - 24x = 1536 - 20x. Therefore 4x = 256, and  $x = 256 \div 4 = 64$ ,

(7) Given 36—4x = 8

Then by multiplying both fides of the Equation by 9, we have 324-4x=72.

Therefore 4x=324-72=252. Threefore  $x=252\div 4=63$ .

(8) Given  $\frac{2 \ x}{3} = \frac{176 - 4x}{5}$ Then 10x = 528 - 12x. And 22x = 528. Therefore  $x = 528 \div 22 = 24$ .

(9) Given  $\frac{45}{2x+3} = \frac{57}{4x-5}$ Then multiplying by 2 x+ 3, we shall have 45 =  $\frac{114x+171}{4x-5}$ ; also multiplying by 4x-5, we have 180x-225=114x+171.

Therefore 180x - 14x - 225 = 171, that is 66x = 225 + 396 = 171 = 396, and  $x = 396 \div 66 = 6$ .

(10) Given  $\frac{42x}{x-2} = \frac{35x}{x-3}$ 

Then by multiplying by x=2, and x=3, we get  $42x^2=126x=35xx=70x$ .

Therefore  $42x^2-35x^2=126x-70x$ , that is  $7x^2=56x$ . Therefore by dividing by 7x, we have x=3,

(11) Given  $\frac{xx-12}{3} = \frac{xx-4}{4}$ 

Then by multiplying both Sides of the Equation by 3, and 4, we have  $4x^2-48=3x^2-12$ .

Therefore  $4x^3-3x^2=48-12$ , that  $x^2=36$ .

Whence  $x=\sqrt{3}6=6$ .

(12) Given  $\frac{5xx}{16} = 8 + 12$ .

Then by multiplying by 16, we get  $5x^2=20 \times 16=320$ . Therefore  $x^2=320 \div 5=64$ , and  $x=\sqrt{64}=8$ .

(13) Given  $\frac{x+i}{2} + \frac{x+2}{3} = 16 - \frac{x+3}{4}$ 

Then by multiplying by 2, 3, and 4, we get 12x+12+8x+16=384-6x-18, that is 20x+28=366-6x. Therefore 20x+6x=366-28, that is 26x=338. Whence  $x=338\div26=13$ .

(14) Given  $ax + b^2 = \frac{ax^2 + ac^2}{a + x}$ .

Then,  $ax+b^2 \times a+x=ax^2+ac^3$ , that is  $a^2x+ab^2+ax^2+b^2x=ax^2+ac^2$ .

Therefore  $a^3x + b^2x = ac^2 - ab^2$ , and  $x = \frac{ac^2 - ab^2}{a^2 + b^2}$ .

(15) Given  $\sqrt{\frac{5^x}{3}} + 12 = 17$ .

Then  $\sqrt{\frac{5^x}{3}} = 17 - 12 = 5$ , and  $\sqrt{5^x} = 5 \times 3 = 15$ .

Therefore (by Rule IV.) 5x=225, and  $x=225\div 5=45$ .

(16) Given  $\sqrt{12+x}=2+\sqrt{x}$ , then (by Rule IV.)  $12+x=4+4\sqrt{x+x}$ .

Whence by Transposition  $4 \vee x=8$ , and by Division  $\vee x=2$ , consequently x=4.

(17) Given  $\sqrt{x} + \sqrt{a+x} = \sqrt{\frac{2a}{a+x}}$ 

Then  $\sqrt{ax+xx+a}+x=2a$ , or  $\sqrt{ax+xx}=a-x$ . Whence  $ax+x^2=a^2-2ax+x^2$ ,

Therefore gax=a2.

 $\therefore x = \frac{a^2}{3}.$ 

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(18) Given  $615x-7x^3=48x$ . Then by Transposition  $615x-48x=7x^3$ , that is  $7x^3=567x$ .

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Whence divided by 7x, we get  $x^2=81$ . x=9.

(19) Given  $\sqrt{a^2 + x^2} = \sqrt{b^4 + x^4}$ 

Then by raising both Sides to the fourth Power, we have  $ac + xx^2 = b^4 + x^4$ , that is  $a^4 + 2a^2x^2 + x^4 = b^4 + x^4$ Therefore  $2a^2x^2 = b^4 - a^2$ .

 $x^2 = \frac{b^4 - a^4}{2a^4} = \frac{b^4}{a^4} - a^2.$ 

88. Of the EXTERMINATION of UNKNOWN QUAN. TITIES; Or, the REDUCTION of Two or more EQUATIONS, to a fingle One.

(1) Given  $\begin{cases} 5x + 8y = 106 \\ 4x - 5y = 5 \end{cases}$ 

Here, by multiplying the first Equation by 4, and the second by 5, in order that the Coefficients of x, may be the same in both, there arises,

25x + 32y = 434 20x - 25y = 25

By fubtracting the latter from the former we have 57y =

Hence  $y = \frac{399}{57} = 7$ 

And so by the first Equation  $x = \frac{3+5\times7}{4} = \frac{40}{4} = 10$ .

(2) Given { 5x 3y±150 | 15x 3y=150 | 15x 3y=

Here the first Equation being multiplied by 2, (in order that the Coefficients of x, in both Equations, may be the same) we have 10x—6y=300. Let this Equation be subtracted from the second, and we shall have 21y 525.

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Hence 
$$y = \frac{5^2 5}{2100} = 25$$
. Final oils to advoc motion but  $\frac{1}{2}$  was  $\frac{1}{2}$  and find the second

Therefore by the first Equation x=

Given 
$$\begin{cases} \frac{x}{5} = 45. \\ \frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 6z \\ \frac{x}{3} + \frac{y}{4} + \frac{z}{5} = 47. \\ \frac{x}{4} + \frac{y}{5} + \frac{z}{6} = 38. \end{cases}$$

Here the given Equations cleared of the Fractions, become

$$12x + 8y + 6z = 1488$$
  
 $20x + 15y + 12z = 2820$   
 $30x + 24y + 20z = 4560$ 

Now, to exterminate z, let the second of these Equations be subtracted from the double of the first. And also, three Times the third, from four Times the fecond. Whence is had

$$4x + y = 156$$
 $10x + 3y = 420$ 

Again, to exterminate y, from three Times the first take the fecond, and we shall then have 12x-30x=468=

$$x = 48$$
 = 24.

Therefore  $y = 156 - 24 \times 4 = 60$ .

And 
$$z = \left(\frac{1488 - 8y - 12x}{6}\right) = 120.$$

4) Given 
$$\begin{cases} \frac{x}{4} + \frac{y}{5} = 15 \\ \frac{x}{6} + \frac{y}{9} = 9 \end{cases}$$

Here our Equations cleared of Fractions will be

$$5x+4y=300$$
  
 $9x+6y=486$ 

And if from double of the latter we take triple of the former, shall have 18x - 15x = 972 - 900, that is 3x=72.

Whence  $x = \frac{7^2}{3} = 24$ .

And  $y = \frac{800 - 5x}{4} = 45$ .

(5) Given 
$$\begin{cases} \frac{x}{2} & 12 = \frac{y}{4} + 8 \\ \frac{x+y}{5} + \frac{x}{3} - 8 = \frac{2y-x}{4} + 27 \end{cases}$$

Here the Equations cleared of the Fractions we shall have

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4x-96=2y+64And 12x+12y+20x-480=30y-15x+1620

Which contracted, become

4x-2y=64+96=160

From the last of which subtract nine Times the former, and we have 41x-36x=2100-1440, that is 11x=660.

Hence  $x = \frac{660}{11} = 60$ 

And y 4x-160 240-160 80101

(6) Given  $\begin{cases} x+y=80 \\ x+z=70 \\ y+z=60 \end{cases}$ 

Here by subtracting the second Equation from the first (in order to exterminate x) we have y=z=1 or to which the third Equation being added, z will likewise be exterminated, there coming out 2y=70, or y=35.

Whence z=y-10=25, and x=80-y=35.

(7) Given  $\begin{cases} x + 100 = y + z \\ y + 100 = 2x + 2z \\ z + 100 = 2x + 2y \end{cases}$ 

To the double of the first, let the second Equation be added; so shall the x's, on the contrary Sides destroy each other, and we shall have 300+y=2y+4x, or y+4z=300.

Moreover, to the triple of the first let the third Equation be added, whence will be had z+400=6y+3z or 2z' +6y=400.

Now if from the double of this last Equation (which is 4z+12y=800) the former, (viz. y+4x=300) be subtracted, then will come out 11y=500.

Therefore 
$$y = \frac{500}{11} = 45 \frac{5}{11}$$
, and  $z = \frac{300 - y}{4} = 75 - \frac{y}{4}$   
=  $75 - 11 \frac{4}{11} = 63 \frac{7}{11}$ 

And 
$$x=y+z-100=109\frac{1}{11}-100=9\frac{1}{11}$$

(8) Given x-y=2, and xy+5x-6y=120. Then to exterminate x.

By the first Equation x=2+y; which Value being substituted in the last (according to Rule II.) it becomes  $y+2\times y+5\times y+2-6y=120$ , that is  $y^2+2y+5y+$ 10-6y=120, or y2+y=170.

(9) Given  $\begin{cases} x + y = s \\ x^2 - y^2 = d \end{cases}$  quere x and y

Then x=s-y; the Square of which is  $x^2=s^2-2sy+y^2$ . Also  $2x=d+y^2$ .

Therefore  $d+y^2=s^2-2sy+y^2$ .

Hence  $d=s^2-2sy$ .

And 2sy=s2-A

So 
$$y = \frac{s^2 - d}{2s}$$
.

And 
$$x = \frac{s^2 + d}{2s}$$

(10) Given 
$$\begin{cases} x + y + z = 1/2 \\ x + 2y + 3z = 20 \\ \frac{x}{3} + \frac{y}{2} + z = 6 \end{cases}$$
 To find  $x, y, \text{ and } z, z = 1/2$ 

Then we have 
$$\begin{cases} 1. & x=12-y-z \\ 2. & x=20-2y-3z \\ 3. & x=68-\frac{3}{4}y-3z \end{cases}$$

Then we have  $\begin{cases} 1. & x=12-y-z \\ 2. & x=20-2y-3z \\ 3. & x=68-\frac{3}{4}y-3z \end{cases}$ From whence we have  $\begin{cases} 1. & x=12-y-z \\ 2. & x=20-2y-3z \\ 3. & x=68-\frac{3}{4}y-3z \end{cases}$ these two Equations  $\begin{cases} 1. & x=12-y-z \\ 2. & x=20-2y-3z \\ 1. & y=20-2y-3z \end{cases}$ 

Therefore we have (by Rule I.) y=4-z=2, x=6. and

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Sometimes the Equations are such, that the same Quentities in different Equations may have contrary Signs, and destroy each other; or to be otherwise affected, so as to shorten the common Process very much.

Thus 
$$\begin{cases} x+y+z=26 \\ x-y=4 \\ x-z=6 \end{cases}$$
Then by Addition only,  $3x=36$ .
Hence  $x=12$ ,  $y=x-4=8$ , and  $z=x-6=6$ .

### 104. QUADRATIC EQUATIONS.

(1) Given  $x^2-4x=32$ , to find the Value of x. Here  $x^2-4x+4=32+4=36$ , (by Rule III.) And  $x-2=\sqrt{3}6=6$ , (by Rule IV. Therefore x=6+2=8.

(2) Given  $12x^2-420x=-1200$ , to find x. Here  $x^2-35x=-100$ , (by Rule II.) And  $x^2-35x+306,25=206,25$ , (by Rule III.) Also  $x-17,5=\sqrt{209,25}=14,361406$ , (by Rule IV.) Therefore x=31,861406, or 3,138594.

(3) Given  $4x^2+60x=216$ , to find x. Here  $x^2+15x=54$ , (by Rule II.) And  $x^2+15x+56,25=110,25$ . Also  $x+7,5=\sqrt{110},25=10,5$ . Therefore x=10,5-7,5=3.

The fifteen following Equations, or Questions, are from Mr. WARD'S MATHEMATICIAN'S GUIDE.

(1) Given 
$$\begin{cases} a+e=s=240\\ a-e=d=192 \end{cases}$$
 to find the rest.  
Here by Addition we get  $2a=s+d$ .  
Therefore  $a=\frac{s+d}{2}=\frac{240+192}{2}=\frac{432}{2}=216$ .  
Then by subtracting the second Equation from the first

we get 2e = s - d. And  $e = \frac{s - d}{2} = \frac{240 - 192}{2} = \frac{48}{2} = 24$ . Now as a and e are found, the rest may be very easily found as follows:

$$ae = \frac{s_s - dd}{4}$$
 or 2 16×24=5184=p.

And 
$$\frac{a}{e} = \frac{s+d}{s-d}$$
, or 216:24=9=q.

Also 
$$a^2 + e^2 = \frac{s^2 + 2d}{2}$$
, or  $216 \times 216 + 24 \times 24 = 47232$ 

Likewise a2-2=sd, or 216×216-24×24 = 46080

Given  $\begin{cases} a+e=s=240\\ ae=p=5184 \end{cases}$  to find a, e, d, q, z, x. Here by subtracting 4 Times the second Equation from the

Square of the first. we have a2-2ae+e2=s2-4p.

Therefore a-e= Vs2-4=d, Now by adding this Equation to the first we get 2a=s+

Hence 
$$a = \frac{s + \sqrt{ss - 4}}{2} = 216$$
.

And by fubtracting we have 2e=s-V ss-4P

Hence 
$$e = \frac{s - \sqrt{s^2 - 4p}}{2} = 24$$

Therefore the rest may be very easily found by proceeding as in the last Example.

(3) Given 
$$\begin{cases} a + e = s = 240 \\ \frac{a}{e} = q = 9 \end{cases}$$
 to find the rest.

Here by fubtracting the second Equation from the first, we have e=s-ge.

Therefore 
$$e = \frac{s}{9+1}$$
,  $= \frac{240}{10} = 24$ . Which taken from the first Equation gives  $a = s - \frac{s}{q+1} = 240 - \frac{240}{9+1} = \frac{1}{10}$ 

240-24=216. From hence the rest may be very easily found.

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(4) Given  $\begin{cases} a + e = s = 240 \\ a^2 + e^2 = z = 47232 \end{cases}$  to find the rest.

Here from the Square of the first Equation take the second; and we have 2ae=s2-z. Which taken from the second Equation gives  $a-2ac+e2=2z-s^2$ .

Therefore  $a-=\sqrt{2z-s^2}=d$ .

This added to the first Equation gives 2a=s+v2z-s.

Hence 
$$a = \frac{s + \sqrt{2z - 2}}{2} = 216$$

And fubtracted gives 2e=s-V2z-32.

Whence 
$$e = \frac{s - \sqrt{2z - s^2}}{2} = 24$$
.

(5) Given  $\begin{cases} a + e = s = 240 \\ a^2 - e^2 = x = 46080 \end{cases}$  to find the reft. Here the second Equation divided by the first gives

$$a-s=\frac{x}{s}=d.$$

Which added to the first, we have  $2a=s+\frac{x}{s}=\frac{s^2+x}{s}$ 

Hence 
$$a = \frac{s^2 + x}{2s} = 216$$
.

And the third fubtracted from the first gives

$$2e = s - \frac{x}{s^1} = \frac{s^2 - x}{s}$$

Hence 
$$e = \frac{s^2 - x}{2s} = 24$$
.

(E) Given  $\begin{cases} a-e=d=192\\ ae=p=5183 \end{cases}$  to find the rest.

Here to the Square of the first Equation add 4 Times the fecond and we shall have  $a^2 + 2ac + e^2 = 2d + 4p$ .

Therefore  $a+e=\sqrt{aa+4p}=s$ .

This Equation added to the first gives 2a=d+vdd+4P.

Therefore 
$$a = \frac{d + \sqrt{dd + 4p}}{2} = 216$$

Then by taking the first Equation from the fourth, we have  $2e = \sqrt{da \times 4p} - d$ .

Hence 
$$e=\sqrt{\frac{dd+4p-d}{2}}=24$$
.

(7) iven 
$$\begin{cases} a-3=d=192\\ a=q=9 \end{cases}$$
 to, find the rest.

H re by transposing e in the first Equation, and multipl ing the second by e, we get qe=d+e.

I sen 
$$e = \frac{d}{q-1} = 24$$
.  
for  $9 - 1 \times e = qe - e$ . And by adding this last Equation to the first we have  $a = d + \frac{d}{q+1} = 216$ 

(8) Given  $\begin{cases} a - e = d = 192 \\ a^2 + e^2 = z = 47232 \end{cases}$  to find the rest. Here by taking the Square of the first from the second, we have 2ac = z - dd. This added to the second Equation

gives  $a^2 + 2ae + e^2 = ^2z - dd$ . Therefore  $a + e = \sqrt{zz - dd}$ . Which added to the first Equation gives  $2a = d + \sqrt{zz - dd}$ .

Therefore 
$$a = \frac{d + \sqrt{2z-dd}}{2} = 216$$
.

Then by taking the first Equation from the fifth we get  $2e = \sqrt{2z - dd} - d$ . Hence  $e = \sqrt{\frac{zz - dd}{2}}$ .

(9) Given 
$$\begin{cases} a - e = d = 192 \\ a^2 - e = x = 46080 \end{cases}$$
 to find the rest  
Here by dividing the second Equation by the first, we have  $a + e = \frac{x}{d}$  Then by adding this Equation to the the first, we get  $2a = d + \frac{x}{d}$  Hence  $a = \frac{dd + x}{2d}$ .

And by taking this Equation from the third, have  $e = \frac{x - dd}{ad}$ .

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(10) Given  $\left\{ \frac{ae=p=5184}{e=q=9} \right\}$  To find the reft.

Here by multiplying the two Equations together, we have aa=qp. For  $\frac{ae}{4} \times \frac{a}{e} = \frac{aae}{e} = aa$ . Then  $a=\sqrt{qp}$ 

And by dividing the first Equation by the second, we shall have  $ee = \frac{p}{q}$ .

For  $\frac{a}{1}$   $\frac{ae}{1}$   $\left(\frac{aee}{a} = ee. \text{ Hence } e = \sqrt{\frac{p}{q}} = 24.\right)$ 

(11) Given  $\begin{cases} ae & =p=5184 \\ e^2+e^2=z=47232 \end{cases}$  to find the rest.

Here to the second add twice the first, and we have  $a^2 + 2ae + e = z + 2p$ .

Therefore  $a+e=\sqrt{z+2p}=s$ .

Then by taking twice the first Equation from the second, we have  $a^2 - 2ae + e = x - 2p$ .

Hence  $a - e = \sqrt{z-2p}$ . This Equation added to the fourth, gives  $2a = \sqrt{z+2p} + \sqrt{z-2p}$ .

Therefore  $a = \frac{\sqrt{z+2p+\sqrt{z-2p}}}{2} = 216$ .

Then by taking the fixth Equation from the fourth, we have  $2e = \sqrt{z+2p} - \sqrt{z-2p}$ .

Hence  $e = \frac{\sqrt{z+2p} - \sqrt{z-2p}}{2} = 24$ .

(12) Given  $\begin{cases} ae & =p=5184 \\ a^2-e=x_46380 \end{cases}$  to find the reft.

Here to the Square of the fecond Equation add 4 Times the Square of the first, and we shall have a4+2a2c2+

 $e^{x} = xx + 3p^{2}$ . Hence  $a^{2} + e^{2} = \sqrt{x^{2} + 4p \pm z}$ .

This Equation added to the fecond will give 2a2=x+

 $\sqrt{x^2+4p^2}$ . Whence  $a=\sqrt{x+\sqrt{x^2+4p^2}}=216$ .

Then by subtracting the second Equation from the fourth, we have  $2e^2 = \sqrt{x^2 + 4p^2} - x$ .

Hence  $e = \sqrt{\frac{14p^2 - x}{x^2 + 4p^2 - x}} = 24$ 

(13) Given  $\begin{cases} \frac{a}{e} = q = 9 \end{cases}$  to find the rest.

a<sup>2</sup>+e<sup>2</sup>=z=47232

Here from the second Equation take the Square of the first, and we shall have ee=z-qqee, or qqee+ee=z.

Hence  $ee = \frac{z}{qq+1}$ . For  $qq+1 \times ee = qqee + ee$ . There

fore  $e=\sqrt{\frac{z}{qq+1}}=24$ .

Then by taking this last Equation from the second we

have  $aa=z\frac{z}{qq+1}=\frac{qqz}{qq+1}$ . Hence  $a=\sqrt{\frac{qqz}{qq+1}}$ 

(14) Given  $\left\{\frac{a}{e}\right\} = q = 9$  to find the rest.

Here by comparing the first when multiplied by e, and squared with the second more ee, we have qqee=x+ee, or qqee=ee=x.

Hence  $ee = \frac{x}{qq-1}$ Therefore  $e = \sqrt{\frac{x}{qq-1}} = 24$ 

Then by adding the fourth Equation to the fecond, we

get  $aa = x + \frac{x}{qq-1} = \frac{qqx}{qq-1}$ . Hence  $a = \sqrt{\frac{qqx}{qq-1}}$ 

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(15) Given  $\begin{cases} aa + ee = z = 47^23^2 \\ aa - ee = x = 46080 \end{cases}$  to find the rest. Here by Addition (only) we have 2aa = x + z.

Hence 
$$a = \sqrt{\frac{x+z}{z}}$$

Then by subtracting the second Equation from the first, we get 2ee=z-x.

Therefore 
$$e=\sqrt{\frac{2-x}{2}}$$

The Reason of my proceeding (only) with the first Question throughout, is being confined, not having Room; but I hope this will not be the Pupil's Case.

#### PROBLEMS.

- (1) Here let x=the greater Number.

  Then x-20=the leffer.

  Which added together gives 2x-20=70.

  Therefore 2x=70+20=90.

  And x=90÷2=45, the greater Number.

  : 45-20=25, the leffer.

  For 45-25=20.

  And 45+25=70.
- (2) Here let x=the greater Number. Then x-14=the leffer.

Therefore by the Quest.  $\frac{x}{x-14} = 3$ . Hence x=3x-42, and 2x=42.  $\therefore x=42 \div 2=21$ , the greater Number, Likewise 21-14=7, the lesser. For 2-7=14. Also  $21 \div 7=3$ .

(3) Suppose x to be the Number.

Then by the Quest.  $\frac{x}{3} + \frac{x}{4} = 21$ .

Therefore 7x = 252.

Hence x = 36, the Number required.

For  $\frac{36}{3} + \frac{36}{4} = 12 + 9 = 21$ .

(4) Let x be the Number.

Then per Queft.  $\frac{x}{3} = \frac{x}{4} = 4$ .

Hence x=48, the Number required.

For  $\frac{4^8}{3}$   $\frac{4^3}{4}$  = 16-12=4.

(5) Suppose x=the Number required.

Then per Quest.  $\frac{x}{3} - 4 = \frac{x}{4}, -25.$ 

Hence 4x-48=3x-3. Therefore by Transposition x=45.

For  $\frac{45}{3}$   $-4 = \frac{45}{4}$  , 25 = 15 - 4 = 11, 25 - , 25.

(6) Let x represent the greater, and x-8 the lesser Number.

Then per Quest. 16x-64=208.

Hence 16x=272, and x=17, the greater.

Also 17-8=9, the lesser Number. For 17-9=8, the Difference.

And 17×17-9×9=289-81=208.

- The above Question may be solved by making Use of two Letters, see Mr. WARD's 9th Question.
- (7) Let x=the greater Number, and y the lesser.

Then by Quest. we shall have x+y=60.

And as x:y::9:3.

Therefore 9y=3x, or 9y-3x=0.

To which add the first Equation multiplied by 3, and we shall have 12y=180.

"y=15, the leffer Number.

And 60-15=45, the greater.

For 45+15=60

And as 45: 15::9:3.

(8) Here let x= the greater Number, and y the leffer, Then per Quest. xy=108.

And  $\frac{3x}{y} = 4$ .

Therefore by destroying x, we shall have  $\frac{108}{v} = \frac{4y}{3}$ .

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Hence 4y2=324, and y2=81. .. y=9, the lesser Number.

And 108 = 12, the greater,

For 12 X9-108.

Also  $\frac{12\times3}{9} = \frac{36}{9} = 4$ .

(9) Let x= the greater Number, and y the leffer. Then by the Question we shall have

1. 
$$x+y+8=2x$$

2. 
$$x-y-4.5=\frac{y}{2}$$

Then by multiplying the fecond Equation by 2, we get

2x-2y-9=y. And by the first Equation x=y+8.

Which substituted for x in the last Equation, we shall have y=7, the leffer Number.

Then x=7+8=15, the greater. For 15+7+8=15×2=30.

(10) For the Number fought, put x, y, and z.

Then by the Question we shall have

1. 
$$x + \frac{y+z}{2} =$$
  
2.  $y + \frac{x+z}{3} =$   
3.  $z + \frac{x+y}{4} =$ 

Then by clearing the Equations of the Fractions, we get

4. 
$$2x+y+z=2a$$

5. 
$$3y + x + z = 3a$$
  
6.  $4z + x + y = 4a$ 

6. 
$$4z+x+y=4a$$

Now (to exterminate z) let the fourth Equation be subtracted from the fifth; also the fixth from four Times the fifth, whence is had

7. 
$$2y - x = a$$
  
8.  $11y + 3x = 8a$ 

From which we have 
$$2y-a=\frac{8a-11y}{3}$$
.

Therefore 17y=11a=314.

Hence  $y = \frac{314}{17} = 22$ .

Then by the feventh, x=44-34=16. Also by the fourth, z=68-42=26.

For  $10 + \frac{22 + 26}{2} = 34$ .

And  $22 + \frac{10 + 26}{3} = 34$ 

Alfo 26+ $\frac{10+22}{4}$ =34.

(11) Let 3x=the major Part of the first Division.

Then 100-3x=the minor Part.

And by the Question we shall have x=the minor Part of the second Division.

Also 100-x=the major Part.

Whence by the Question 100-x=200-6x.

Hence  $x = \frac{100}{5} = 20$ , the minor Part of the 2d Division.

And 100-20=80, the major Part.

Again 20×3 =60, major Part of the first Division.

And 100-60=40, minor ( 1 at of For  $60=20\times3$ , and  $80=40,\times2$ .

(12) Let x represent A's Contribution.

Then x+10=B's by the Question. And 2x+10=C's

Therefore 4x+20=76.

Hence  $x = \frac{76 - 20}{4} = 14 \text{ A's.}$ 

And 14+10=24 B's.

Also 14×2+10=38f. C's Contribution.

(13) Let x=the Length.

Then 52-x= the Breadth.

Now 52x-xx=480, per Question.

Therefore xx-52x=-480.

And xx-52x+676=676-480=196.

x-26=14.

Hence x=40 in Length.

And 52-40=12, in Breadth.

This Question may be solved by making use of two Letters. See Mr. WARD's second Question.

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(14) Suppose x=he Quantity fold at 12d. per lb.

Then as  $\frac{3}{4}:\frac{2}{3}*x:\frac{8x}{9}$  = the other at 1.5d. per lb.

Therefore by multiplying each Quantity by its Price, we have  $12x + \frac{40x}{2} = 19 \times 2 = 228$ .

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Hence 36x + 40x = 684.

From which  $x = \frac{684}{76} = 9$ lb. a 1s. and  $\frac{8x}{9} = 8$ lb. at 1s. 3d. per lb.

For as 9:8 :: 3 to 3.

(15) Suppose he had x Guineas.

Then by the Quest.  $x-\frac{x}{4}+\frac{x}{5}=66$ .

20x-9x=1320. Hence 11x=1320.

And x=120 Guineas, had at firl.

(16) Let x=the greater, and y the leffer Number.

Then xx+xy=77. by the Question. And xy-yy=12

Now by destroying xy, we get the following Equation, 77-xx=12+yy.

Hence xx=65-yy.

 $x = \sqrt{65} - yy$ .

Then by substituting this for x, in the second Equation we have  $y \sqrt{65-yy}-yy=12$ .

Or  $\sqrt{65-yy} = \frac{12+yy}{y}$ 

Then by squaring each Side, 65-yr= 144+24y2+4

Or 2y4-41y2=-144.

Therefore by : 2, were have y4-205y2=-72.

And by completing the Square, we get y4-20,5 y2
105,0625=33,0625.

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Or y2-10,25=V33,0625=5,74

Then y2=16.

Hence y=4, and 65-16=49=x2.

Therefore x=7.

(17) Let x= the Number required. Then by the Quest. 4xx-40x+100-1=7x. Or  $4x^2-47x=-99$ .

Therefore by :- 4, we havex 2—11,75x=-24,75.

Or  $x^2 - 11,75x + 34.515625 = 9,765625$ .

 $x-55,875=\sqrt{9,7656}-25=3,125$ 

Hence x=3,125+5,875=9, the Number required.

For 9×2-10=8.

Alfo  $8 \times 8 - 1 = 9 \times 7 = 63$ .

(18) Here let x=his Part, and y her's.

Then  $\begin{cases} \frac{x}{5} = \frac{y}{4} + 10 \\ \frac{x}{4} + y = 1000 \end{cases}$  by the Question.

Therefore by destroying the x's we get  $\frac{5y+200}{4}$  = 1000 y

Or 5y+200=4000-4y.

Then y=38100: 9=4222 her And 1000-4222=5772 his Share.

(19) Let x= the least Number.

Then we shall have x, x+2, x+4, and x+6, for the Numbers.

But  $x \times x + 2 \times x + 4 \times x + 6 = x^4 + 12x^3 + 44x^2 + 48x$ . Therefore  $x^4 + 12x^3 + 44x^2 + 48x = 945$ , (by the Qeuft.)

Wherefore  $105x^2 = 945$ . Hence  $x^2 = 9$ . And x = 3, the leaft.

Therefore the Number are 3, 5, 7, and 9.

(20) Put x=his Age in Months.

Then  $x + \frac{x}{2} + \frac{x}{8} - 1 \Rightarrow 21 \times 21 = 441$ , (by the Queff.)

Or 16x+8x+2x-16=7056. Or 26x=7072,

Hencex=  $\frac{7072}{26}$  = 272 m. or 22 yrs. 8 m. his Age.

For  $272 + \frac{272}{2} + \frac{272}{8} - 1 = 21 \times 21 = 441$ .

(21) Let x, y, and z, be the Numbers required.

Then per Queft, x-y=6; or y-6=x, and z-y=15; or z=15+y.

But x: y :: y : z; that is y-6: y:: y: 15+y.

Therefore yy-90+9y=yy. Hence 9y=90. And y=10, the second.

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Then 10-6=4, the first.

And 15+10=25, the third Number

(22) Suppose x to be the Number.

Then  $x^6 - 19x^3 = 216$ , (by the Quest.)

Put  $x^3 = z, x^6 = z^2$ , and it will be  $z^2 - 19z + \frac{361}{4} =$ 

$$216 + \frac{361}{4} = \frac{1225}{4}$$

And 
$$z = \frac{19}{2} = \pm \frac{35}{2}$$
. Whence  $z = \frac{19 \pm 35}{2} = 27$ ,

or = -8. But  $x = \sqrt{z}$ . Therefore x = +3, or -2. (23) Let x = the Length.

Then per Quest.  $3:2::x:\frac{2x}{3}$  = the Breadth.

Therefore  $\frac{x \times 2x}{3}$  = 60000, or 2xx = 180000

Hence xx=90000. And x=300 Men in Rank.

Alfo = 200 Men in File.

Now 330—1 × 2,75=822,25 yds. Length And 200—1 × 2,75=547,25 ditto Breadth.

4840)4499763125(92 ac. 3 rds. 35,2 p. the Ground they stand on.

(24) Put x the Side of the Square.

Then xx+284=the whole Army.

And x+1=the Number of Men designed for the Side of the Square.

Consequently xx+2x+1-25=xx+284. And by Transposition 2x=308. Hence x=154 Men, the Side of the Square.

Wherefore 154 × 154 + 284=24000 Men, the whole Army required.

(25) Suppose x= what he received.

Then per Quest.  $\frac{x-94}{2} + \frac{x-94}{5} + \frac{x}{10} + 94 = x$ .

This Equation cleared of the Fractions, we shall have 50x-4700+20x-1880+10x+9400=100x or 20x=2820.

Hence x=141f. the fum required.

(26) Put DF=9=a, DE=C2=b, and x=AD=DB.

Then DB=a+x, and AB

=EB=a+x-b.
Therefore by the 47th of
Eucrip's first book, we

herefore by the 47th of Euclid's first book, we B

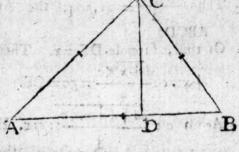
have  $DB^2 = AB^2 + AD^2$ , that is,  $a^2 + 2ax + x^2 = x^2 + a^2 + 2ax + 2ab + x^2 - 2bx + b^2$ ; or  $x^2 - 2bx = 2$ 

Then by Comp. the Square we get  $x^2-2bx+b^2=2ab$ . Therefore  $x-b=\sqrt{2ab}$ . Hence  $x=\sqrt{2ab}+b=$ 

√2×9×2+2=8=AD, the Breadth.

Alfo 9+8=17=AB, the Length.

(27) Here AB=15=a, AC=14=b, BC=13=c, and x=BD, Then by the 47th of Book I. of Euclid, we fhall have  $AB^2 - BD^2 = AC^2 - CD^2$ . Or  $^2-x^2 = b^2-c^2+2cx-x^2$ 



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Q. E. F.

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That is  $a = b^2 - c^2 + 2cx$ .

And by Transposition we get  $2cx=a-b^2+c^2$ . Hence  $x = \frac{a^2-b^2+c^2}{2c^2-b^2+c^2} = \frac{169-196+2}{25} = \frac{198}{25} = 6,6 = B$  D.

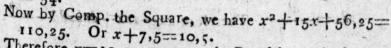
And 15-6,6=8,4=DA.

(28) Let x = the Breadth fought.

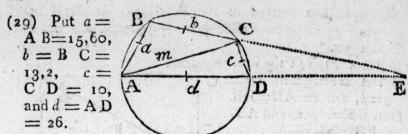
18+2x=Length AB or CD, 12+2x=AD or BC.

Hence  $4x^2 + 60x + 216 = 18$  $\times 12 \times 2 = 432$ . Or  $4x^2 + 60x = 422 = 216 = 276$ 

 $\begin{array}{c}
60x = 432 - 216 = 216. \\
\text{Which # 4 gives } x^2 + 15x
\end{array}$ 



Therefore x=10,5-7,5=3, the Breadth required.



Also m=AC, and y the Co-fine of the Angle D, and -y

= the Co-fine of the Angle B.

Then (per Theo. p. 12. in Mr. Ant. Tacker's Miscel.) we shall have  $a^2 + b^2 + 2ab = m^2$ , and  $d^2 + c^2 - 2cd$ .  $\therefore a^2 + b^2 + 2ab = d^2 + c^2 = 2dc$ . Hence  $2aby + 2dcy = a^2 + c^2 - a^2 - b^2$ . And  $y = \frac{d^2 + c^2 - a^2 - b^2}{2ab + 2ac}$ , whose Sine call s.

Then  $\frac{abs+ds}{2}$  = 21,504, the Area of the Trapezium ABCD.

Or thus, suppose DE=x. Then by sim. Triangles a:d +x::c: $\frac{d+x\times c}{a}$ =50=CE. ..BE= $\frac{ba+d+xxc}{a}$ =

Again  $a: \frac{ba+d+x\times c}{a}: c:x$ . Hence  $x=\frac{ab+cd\times c}{a^2-c^2}$ 

32,5. And the Area of the Trapezium ABCD= 21,504 Acres as before (by Sect. 70. Prob. III. Rule III.)

(30) Put AB=100=a, C
BC = 80 = b, AF =
CD, the Breadth of G
the Walk = x.
Then FG=a-x, GD

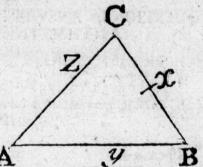
the Question, be equal to  $\frac{ab}{2}$ . Hence this Equation  $ab-ax-bx+x_3=\frac{ab}{2}$ . But 2d=a+b. Then  $xx-bx+x_3=\frac{ab}{2}$ .

 $2dx = -\frac{ab}{2}$ . Therefore  $xx - 2dx + da = dd - \frac{ab}{2}$ .

Confequently 
$$x-d=\sqrt{\frac{ab}{dd-\frac{ab}{2}}}$$
. Hence  $x=d$ 

 $\sqrt{\frac{ab}{dd-\frac{ab}{2}}}$ =90-64,031=25,969 the Breadth req.

(31) Here put s and c for the natural Sine and Co-fide of the Angle ABC, Radius = 1, a for the Area of the Triangle, m for the Sum of the Cubes of the Sides, and x, y, and z, for the Sides, as in the Figure.



Then we shall have sxy = 2a, and  $x^2 + y^2 = z^2 + 2cxy$  (per Trigonometry.)

Hence  $x.y = \frac{2a}{s}$  which call p, and  $x^2 + y^2 = z^2 + 2cp$ , for 2cp put b; then  $x^2 + y^2 = z + b$ .

Now  $x = \frac{p}{y}$ ,  $x^3 = \frac{p^3}{y^3}$ , and therefore the Equation  $x^5 + y^3 + z^3 = m$ , as given by the Question, becomes  $\frac{p^3}{y^3} + y^3 + z^3 = m$ , whence  $z^3 = m - y - \frac{p^3}{y^3}$ .

Again  $z^2 = x^2 + y^2 - b$ , whence  $z^2 = \frac{p^3}{y^2} + y^2 - b$ , con-

fequently  $z^6 = m - y^3 - \frac{p^3}{y^3}^2$ , and  $z^6 = \frac{p}{y^9} + \frac{p^3}{y^9}$ 

hence  $my^3 - y^6 - p^3^2 - p^2 + y^4 - by^3^3$ . This Equation properly reduced will give y = 8, from whence x is found to = 10, and z = 6, the Sides req.

Suppose the Sum of the Squares of the Sides had been given, instead of the Sum of the Cubes: then we should have had  $x^2+y^2+z^2=m$ , and the other equations as before, viz. xy=p, and  $x^2+y^2=z^2+b$ , hence  $z^2+b+$ 

 $z^2m$ ; or  $z=\sqrt{\frac{m-b}{2}}$ , which being now known,

put  $z^2+b=n$ , then  $x^2+y^2=n$ ; but xy=p, therefore  $x^2+2xy+y^2=n+2p$ , and  $x^2-2xy+y^2=n-2p$ , confequently  $x+y=\sqrt{n+2p}$ , and  $x-y=\sqrt{n-2p}$ ; therefore  $x=\sqrt{\frac{-n+2p+\sqrt{n-2p}}{2}}$ .

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## QUESTIONS, ANSWERED (both) by COMMON ARITHMETIC, and ALGEBRA.

(1) First 76×56=3256.

And  $\sqrt{4256} = 65,238 + 1b$ . the true Weight required.

(2) First 1 lb. = the first or least Weight.

Then 
$$\frac{1}{2+1}$$
 = 1 first.  
And  $\frac{2+1}{3+1\times 2+1}$  = 9 third.  
Also  $\frac{3+1\times 2+1}{9+3+1\times 2+1}$  = 27 fourth

Weight.

Sum of which =40 the whole Weight.

(3) First 6s. 4d .= 289 Farthings.

Then  $\sqrt{289} = 17$  Persons. Of 17 qrs. =4\frac{1}{2}d. what each spent.

(4) Here x = the Number of Spots. n=7, r=12, and w=52.

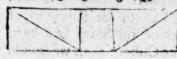
Then per Theo.  $x=13\times n-w+r=13\times 7-52+12$ .

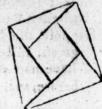
Therefore x=103-52=51 Spots.

(5) Supposing the Oranges to be laid in Rows, and upon each other; then the Solution will be thus 2,5×2,5

×2,5×2000=31250.

.. 131250=31,498 Inches, infide of the Box.





(6) Let Fig. 1. represent the Plank as is to be cut, and the second Fig. as they are placed to make the Square.

(7) The Hour-hand goes only  $\frac{1}{12}$ , the Circumference in an Hour, the other goes the whole, or  $\frac{12}{12}$ =1.

Then  $\frac{12}{12}$   $\frac{1}{12}$   $\frac{1}{12}$ , Minute-hand gains in an Hour.

Therefore as  $\frac{1}{12}$  cir. : 1 h. or :: 1 cir. :  $\frac{13}{12}$  h. = 1 h.  $5\frac{3}{12}$  m. .: 1 h.  $5\frac{5}{12}$  × 5 =  $27\frac{3}{12}$  min, past 5, the Time required.

For when the Hands are in Opposition, the Minute must be 75 a Head of the Hour-hand.

Hence as 11: 1 h. or 60 min. :: 6: 327 min. past 12.

And for the next Conjunction it will be as 11: 1 h. ::

6×1(12): = 12 rh. 5: 574 min. as above.

As in : 1: 12 + 12 (24): 11 = 2 h? 11 11 the next

Conjunction.

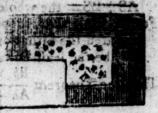
Alfo as 11: 1th. : (12×5860): 57=5 h. 27 7= 277

(8) Let ABCD, Fig. 2, C
represent the given
Table = 27 Inches,
and the Parallelogram

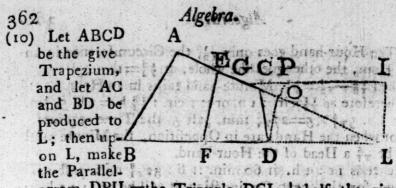
EFGH Fig. 1, represent the Plank = 4 ft.
which as (per Quest.) must be cut into sour equal Parts,
viz. EGI, KIG, IKE, and FHK

Then by properly applying the four equal Parts in the Parallelogram EFGH, to the given Table ABCD, there will EGI be to NBD, KIG=LAB, IKF MCA, and HFK will be to ODC, which makes LMNO, a complete Square, each Side thereof=36 Inches, which was required.

(9) If the Remainder of the Land be divided into four Parts, as in the annexed Plan, these Parts will be equal and similar to each other.



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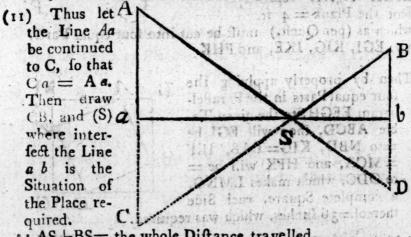


ogram DPIL the Triangle DCL + half the given Trapezium, and making the Angle LDO=LOD, produce IP to meet AL in G; then take EL, a mean Proportional between PI, and 2 GL, and draw EF parallel to PD, so will EF be the Line required,

Demonstration, from the Similarity of Triangles, we have GLXLI: GL 2:: PIXLI:EL 2, consequently EL 2

=2 GL $\times$ PI.

Therefore when the Triangle LEF = the Parallelogram PDLI, then EL will be a mean Proportional between 2GL, and PI, and EF is the shortest Line possible. Q. E. D. (See Theo. X. p. 112 of SIMPSON'S GEOM.)



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.. AS+BS= the whole Distance travelled.

For Example thus, suppose ab=50, Aa=40, and Bb= required the Situation of a Place S, so that SA + SB, may be the least Distance possible. Dag Lands 3d liny

 $Bb \times ab$ Then the Theorem  $\frac{Bb}{Aa + Bb} = Sb$ , when AS+SB is the

130 × 50 1500 = 21,42857 =least possible that is 40+30 70 Therefore Sa=28,57143.

(12) Suppose x=the Number of Servants.

Then by the Appendix we have  $\frac{x+1}{x-1} = 960799$ , all

the possible Variations of the Servants; which Equation folyed, will give x = 7, the Mumber of Servants required.

#### GENEALOGICAL PARADOXES.

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(1) Lot committing Incest with his two Daughters, and having by each of them a Son, produced that Paradoxical Relation of the Sons to each other; for by that Means, Lot became, at the same Time, their Father land Grandsather; and they were Brothers, and first Cousins to each other; also each Mother was Aunt to the other's Son. See Gen. xix. ver. 31, to the End.

(2) The Lord God formed the first Man, Adam, of the Dust of the Ground; Gen. ii. ver. 7, and from Adam made he a Woman, and called her Name Eve. Gen. ii. ver. 22. Now Abel (who was the second Son of Adam and Eve his Wife) was murdered by his Brother Cain; therefore he got the Maidenhead of his Grandmother (the Earth) and was got before his Father (Adam) who was made of the Earth, therefore was not begotten: and was born before his Mother (Eve) who was made of Man, therefore was not born.

# APPENDIX.

## 1. CONCERNING DIVISORS.

IT being often necessary in arithmetical Calculations, to find such Multipliers or Numbers, which may be divided by any Number of given Divisors, without any Remainder, or Remainders; by which Means many pleasant Questions, not reducible to any other Rule in common Arithmetic, may be solved.

To find the least Number that can be divided by any Number of Divisors with a Remainder.

#### RULE.

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Multiply all the Prime \* Numbers, and the Root of such as are Square or Cube Numbers, continually; the Product will be the Number required.

#### EXAMPLES.

(1) Required the three least Numbers, which divided by 20 shall leave 19 for a Remainder; but, if divided by 19, shall leave 18; if divided by 18 shall leave 17; and so on, always leaving one less than the Divisor, to Unity.

By Algebra thus, suppose x=the least Number possible.

And let a, b, c, d, &c. represent the Quotients respectively produced by dividing x, by 2, 3, 4, 5, &c. then will the Remainders be 1, 2, 3, 4, &c. Hence x=2a+1=gb+2=4c+3=5d+4, &c. to 20A+19.

Now  $a=b+\frac{b+1}{2}$ . Hence m+1 = m a, a whole

Number. b=2m-1, and a=3m-1.

Again  $c=m-1+\frac{m}{2}$ . Hence  $\frac{m}{2}=n$ . a whole Numb.

And therefore m=2n, c=3n-1, and proceeding in this Manner we get A=11639628 B-1; hence the Number required x=232792560 B-1, where B represents any whole positive Number; and when B=1, then the Number required x=23279.

The Number required x=232792560-1 = 2327925592d.  $232792560 \times 2-1 = 465585119$ 3d.  $232792560 \times 3-1 = 698377679$ 

And thus may be performed other Numbers ad infinitum. Or thus by the Rule,

First 1, 2, 3, 5, 7, 11, 13, 17, and 19, are prime Numbs.

Alfo  $\sqrt{4}=2$ ,  $\sqrt{8}=2$ ,  $\sqrt{9}=3$ , and  $\sqrt{16}=2$ , and all the rest are composite Numbers.

<sup>\*</sup> A Prime Number, is fuch a Number as cannot be produced by the multiplication of two or more Integers.

.. 1×2×3×2×5×7×2×3×11×13×2×17×19= 232792560, the least Number that can be divided by the given Divitors without a Remainder, as before.

(2) What's the least Number that can be divided by the Nine Digits, without a Remainder.

LADIES DIARY, 1719.

of the england

Divifors, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Now  $\sqrt{4}=2$ ; 6 may be cancelled, being composed  $2\times 3$  and 3, 5, and 7 are Prime Numbers.

And  $\sqrt{8}=2$ . Also  $\sqrt{9}=3$ .

Then per Rule 1 × 2 × 3 × 2 × 5 × 7 × 2 × 3 = 2520.

(3) A Country Girl to Town did go, Some Walnuts there to fell;

A Gentleman she chanc'd to meet,
And thus it her befel:

My pretty Maid, fays he to her, What Number have you here?

I can't tell, Sir, faid she to him,
But this I'll make appear;

I told them o'er, ere I came out,

By fix's, five's, four's, three's, two's;
And every Time I number'd them,

One remained Overplus : or and the O bried www.

I told them o'er by fevens at last,

And there were no Remains: If you can find the Number out,

Pray take it for your Pains.

First, the least Number that can be divided by 1, 2, 3, 4, 5, 6, without a Remainder, will be  $1 \times 2 \times 3 \times 2 \times 5 = 60$ , per Rule.

Then 60+ 1=61, will leave 1, when - 2, 3, 4, 5, 6.

But 7)61 (8, and 5 Remains.

Also  $60 \times 2 + 1 = 121$   $\begin{array}{ccc}
60 \times 3 + 1 &= 181 \\
\hline
60 \times 4 + 1 &= 241
\end{array}$ None of which are divisible by
7, without a Remainder.

But 60×5+ 1 = gor, is the least Number which admits of the Conditions of the Question.

Then to find the next least Number which admits of the fame Conditions, we shall find by proceeding as above, to be 60 × 12+1=721.

Also 721-301=420, the common Difference of all the Numbers answering the Conditions of the Question.

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(4) To find the least Number of Guineas, which being divided by 6, 5, 4, 3, and 1, respectively shall leave 5, 4, 3, 2, and 2, respectively remaining.

First 1×2×3×2×5=60, the least Number; which will divide by 2, 3, 4, 5, and 6, as by the last Question.

## ... 60—1=59, Q. E. F.

#### 2. COMBINATIONS.

Combinations of Quantities, is the Manner of finding how many different Ways they may be varied, being taken 1 and 1, 2 and 2, 3, and 3, &c. as the Number of Combination of three Quantities, viz, a, b, and c, viz, ab, ac, bc. If three Quantities are to be combined, and their Number is only three, as a, b, and c, then the Number of Combinations will be only one, viz. abc; and if there are four Quantities a, b, c, and d, and three to be taken, then the Combinations will be four, viz. abc, aed, bzd, acd; and if the Number of Quantities to be combined be called q, and u, the Number of them to be taken, then the Number of Com-

binations will be  $\frac{q-u+1}{1} \times \frac{q-u+2}{2} \times \frac{q-u+3}{3} \times$ 

 $\frac{q-u+4}{4} \times \frac{q-u+5}{5}$ , &c. For suppose the Number of Quantities to be combined be 6, and the Number of them taken be 4, then the Number of Combinations will be  $\frac{6-4+1}{1} \times \frac{6-4+2}{2} \times \frac{6-4+3}{3} \times \frac{6-4+4}{4} = \frac{1}{1}$ 

 $\times \frac{4}{2} \times \frac{5}{3} \times \frac{6}{4} = 15$ . The Number of all the possible Combinations beginning from the Combination of every two, will be 2q - 9 - 1; as when the Number of Quantities be 5, then the Number of possible Combinations will be  $2^5 - 6 = 36$ . So that if u represents any Number of Quantities

tities, then will u -u express the possible Number of all

the Variation, as if u=7, then  $\frac{7 \times 1}{7-1}$ ,  $7 = \frac{5764901-7}{6} = \frac{5764794}{6} = 960799$ .

To find the different Combinations in any Number, or Quantities.

#### RULE.

Having placed the given Quantity by itself, decrease it gradually by an Unit, so often as there are Quantities in the Combination; placing one above another, with a Sign of Multiplication between them, which Numbers must be multiplied into one another for a dividend; then placing an Unit with the like Number of places, increasing by Unity till you arrive at the Number to be continued; which multiply continually for a Divisor, and the Quotient will be the Number of Combinations sought.

#### EXAMPLES.

(1) How many different Ways may 11 Halfpence hufled in a Hat turn up?

Now to find the different Chances for any Number of Heads, or Tails, let a represent the Heads, and b the Tails; then by the Theorem in Page 328, we shall have at + 11a + 55 + 55a + 55a + 165a + 65a + 65a

Here is to be observed, that a<sup>11</sup>, or all Heads, hath but one way of turning up; the same for b<sup>11</sup>Tails: but 10 Heads and 1 Tail, and the contrary, may come up 11 different Ways each. Also nine Heads and two Tails, or the

contrary may each come up 11 × 19 = 53 different Ways.

Likewise eight Heads and three Tails, or the contrary may come up  $\frac{55 \times 9}{3}$  = 165 different Ways, &c.

It may be also observed, that, by this Theorem, the Unciæ, or Coefficients, do only increase until the Indices of the two Letters become equal, or change Places, and then the rest decrease in the same Order.

(2) A famous General having ferv'd his King,
Long time in Wars, and had victorious been;
For which his Service, with a pleafant Smile,
Ask'd of his King, one Farthing for each File
Of ten Men in a File, which he could then,
Make with a Body of one Hundred Men.
The King, considering his brave Actions past,
And seeming Modesty of his Request,
Gives his Consent. To what will it amount
In sterling Money? Take your Pen and count.

Thus  $\frac{100}{1} \times \frac{99}{2} \times \frac{98}{3} \times \frac{97}{4} \times \frac{96}{5} \times \frac{95}{6} \times \frac{94}{7} \times \frac{93}{8} \times \frac{92}{9} \times \frac{91}{10} = \frac{62815650955520472000}{3628800} = \frac{17310309456440}{Q. E. F.}$ 

(3) Two Gamesters one Day, at Dice they did play,
And being full merry with Wine;
Said B unto A, what odds will you lay
I cast not the six Aces this time?
Says Athen to B, ten to one I'll lay thee,

With fix Dice, the fix Aces you cast not.

Pray youths shew, and here let them know,

For the Odds on the Cast. Sirs, they know not

For the Odds on the Cast, Sirs, they know not. First 6×6×6×6×6×6=46656=66 different Combinations. 1

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(1)

And 1×2×3×4×5×6=720 Variations.
Then 46656-720=45936 Chances against A;
But as A laid to to 1. ... 7200 Chances to B.
Therefore A's Chance to that of B, :: 45936: 7200, or: 6,38: 1. Q.E.F.

(4) Two Gamesters met the other Day,
The one call'd B, the other A;
But having neither Cards nor Dice,
They got to Hotch-cap in a Trice;
With fifteen Halfpence, fair and flat,
All which they husled in a hat;

Says A, to B, all these are mine,
And I will lay a Pint of Wine,
That in two Trials there will be,
Nine Heads or Tails, as here you see—
No Matter which, but on they play'd,
'Till Silver, Brass, and Gold were laid:
But as to B. his Chance was bad,
For he got broke of all he had.
What where the Odds? I pray declare,
Ye ingenious Youths, and place it here.

First 216=65536, Number of different Chances on 16

Now let a represent the Heads, and b the Tails.

Then (by Theo. in p. 328) we wall have a 6+16ab 18 + 1202 4b 2+560a 3b 3+1820a 2b 4+4368a 16b + 8008a 6b 6+11440a 6b, &c.

Then 11440 × 2=22880 Chances for nine Heads, or Tails to come.

.. 65536-2280=42656, Chances, not come up the first Time, viz. 22880 to 42656, that they come up nine Heads or Tails the first Toss.

Therefore as 65536: 22880: 42656: 14892-7.

Then 22880+14892-73=7772-7 for Nine Heads
Alfo 65536-37772-7-367-36763-7 against or 9 Tails.

## MAGICAL SQUARES.

By a Magical we understand a Square divided into several other small equal Squares, filled with Terms of an Arithmetical Progression, so transplanted, that all the same Line or Rank, whether taken perpendicularly, horizontally, or diagonally, make the same Sum.

### EXAMPLE.

(1) The Numbers 1, 2, 3, 4, 5, 6, 7, 8, and 9, being given; to form them in a Magic Square; viz. counting each Rank perpendicularly, horizontally, or diagonally, that these Ranks may be equal to each other.

Suppose it done, and represented in its proper Form, by the following Symbols, placed as follows,

> Mine Heads or Kätled ashere, to the -No Metter which found he bey play'd. Till Silver, Beats, mod Ogld were laid. But as to the Chance was bad.

Then by the (a+2+m=15)

Quest. we (b+e+h = 15)
have 15 required the middle Numb.

Their Sum = 0+6+c+3e+m+4+3=45.

Again a+b+c=15 added together we get a+b+c+mAlso m+h+g=15 s+h+g=20; this taken from the fourth Equation gives g+z=15.

Then  $e = \frac{13}{2} = 5$ , the Middle Number.

Or by Numbers, thus,

First the Sum of the progressional Numbers are 1+2+3 +4+5+6+7+8+9=45.

Then 3=the Namber of Rows.

.. 45 3=15=the Sum of each Side or Rank.

And 13 3=5=the middle Number as before.

Again, to find the corner Figures; and first to find the Figure represented by a. Beginning with r, I find the corner Letter a, or any other Corner Letter cannot be 1; for if a was = 1, them m must = 2,b+c=15-1=14; as also d+g=15-1=14. But there remains no two Numbers after 5, 1, and 9, whose Sum is 14, but 6, and 8.

Then if any of these Figures were b, the other would be c; and then no Figures would remain for the Value of either d or g; wherefore a is not equal to 1, nor any

corner Letter = to 1, or 9.

Now 3 cannot be =a; for if it were, then m should be =7; b+c=15-3=12, as also d+g=12: but there remains no two Numbers after 5, 3, and 7, whose Sum is 12, but 8+4, which cannot answer to b and c, and d and g; wherefore a, or any other corner Letter, is not =3; neither is m, nor another corner Letter =7; from what has been said, it is plain, that (if the Question proposed is capable of being solved) the

Bit in

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2, c=

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Or the

Then the 6, 2 a

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corner Letters are all even Numbers; wherefore if a=2, m, will be =8 and c must be either 4 or 6. Let c=4, then g=6, b=9, d=7, f=3, and h=1; and so the Square will be completed as was required.

St. UL I

But if c=6 (a being=2;) then g=4, b=7, d=9, f=1, and h=3, and then the Squares will stand thus,

	* 800	to the	-	copletours
2	3		O	
Q			1	
-		National Control	0	-
4	3	*	0	

Or they may be found mechanically: thus, fet them all down progressively, about which draw a Square cornerways; thus,

Then set the four angular Figures at the Corners, and put the outermost alternately: that is, place 1 between 8 and 6, 9 between 4 and 2, 3 between 4 and 8, and 7 between 2 and 6; thus,

There are many Ways of constructing Magic Squares, as also many surprising Properties thereto relating, and it is in itself very curious and entertaining; yet it cannot be denied, but that it is of very little or no Use in any other Parts of the Mathematics: therefore, whoever would see more of these Matters, may consult the Diarian Repository, Page 103 to 108, also from p. 225 to 233, where they will find this Subject more largely treated of.

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